Comprehensive Historical Summary Document

Modine Manufacturing Company

Camdenton Missouri Facility

Prepared for

MODINE

Racine, Wisconsin

Prepared by

CH2MHILL

St. Louis, Missouri

December 2005

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December 28, 2005

Christine Kump-Mitchell, P.E.
Environmental Engineer
Missouri Department of Natural Resources
St. Louis Regional Office
7545 S. Lindbergh, Suite 210
St. Louis, MO 63126-4839

Subject: Comprehensive Historical Summary Report
Modine Manufacturing Company
Camdenton, Missouri

Dear Ms. Kump-Mitchell:

Please find enclosed one copy of the above-referenced report that CH2M HILL is submitting on behalf of Modine Manufacturing Company. The report presents a summary of the historical findings from all the investigations conducted at the Modine Facility and the nearby Former Hulett Lagoon. The objective of the report is to provide the MDNR with sufficient information to resolve open issues raised in the Comprehensive Groundwater Monitoring Evaluation (CME) dated March 22, 2005 and the MDNR follow-up letter dated September 1, 2005. Please feel free to call Tom Sanicola (262-636-1649) or me (314-421-0313 Ext. 265) with any questions you may have.

Sincerely,

CH2M HILL

Daniel J. Price, R.G.
Project Manager

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c: Thomas Sanicola - Modine Manufacturing Company
Bob King - Modine Manufacturing Company
Richard Nussbaum - Missouri Department of Natural Resources
Don Van Dyke - Missouri Department of Natural Resources
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David Garrett - EPA Region VII
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1. Introduction

Modine Manufacturing Company (Modine) is submitting this comprehensive historical summary document, in a RCRA Facility Investigation (RFI) report format, as a result of the meeting that was held between Modine and MDNR on August 16, 2005. The objective of this Modified RFI Report is to provide the MDNR with sufficient information to resolve the open issues that were raised in the Comprehensive Groundwater Monitoring Evaluation (CME) dated March 22, 2005 and the MDNR follow-up letter dated September 1, 2005.

The open issues identified include:

- the potential source of volatile organic compounds (VOCs) beneath the building floor near the former Monorail Vapor Degreaser and Still M567 (SWMU 26),
- the potential source of VOCs in soil along the former domestic wastewater line that conveyed wastewater from the facility to the former Hulett Lagoon,
- adequate definition of the extent of trichloroethene (TCE) in groundwater in the shallow "perched " zone and "deep" zone south of the Modine facility,
- adequate definition of the extent of TCE in groundwater in the "perched" zone north of former Hulett Lagoon,
- the possibility of an evaluation of remedial alternatives for the shallow "perched" zone.

This document consists of five sections, described below:

- Section 1 states the objectives of the comprehensive historical summary report and summarizes the facility location and history, and the regulatory history
- Section 2 summarizes the site topography, geologic setting, and hydrogeologic setting
- Section 3 presents a summary of previous investigative and remedial action history
- Section 4 summarizes the conclusions and recommendations
- Section 5 presents references

1.1 Facility Location

The Modine facility is located at 221 Sunset Drive (formerly 179 Sunset Drive) in Camdenton, Missouri. The legal description for the site is NE ¼, NE ¼, Sec. 26, T. 38 N., R. 17 W., Green Bay Terrace Quadrangle, Camden County, Missouri (Figure 1). The facility is bordered by residences to the northwest, north, and east, and is bordered by a wooded

ravine to the south, southwest, and west. The Lake of the Ozarks is located approximately one and one-quarter mile west of the Modine facility.

1.2 Facility History

The facility was owned and operated by Dawson Metal Products from 1967 to 1972. Dawson Metal Products produced air-conditioning coils and feeder parts from aluminum and copper tubing. Sundstrand Tubular Products purchased the facility in 1972, and continued operating it until 1990. In October 1990, Modine Heat Transfer, Inc., a wholly owned subsidiary of Modine Manufacturing Company, purchased the facility. Modine Heat Transfer Inc. merged with Modine Manufacturing Company on April 1, 1997. Modine Manufacturing Company (Modine) is the current owner/operator of the facility.

The manufacturing building was originally constructed in 1967. Since that time, the facility has undergone four expansions, in 1970, 1973, 1979, and 1983 (Figure 2). The building also underwent a complete interior renovation in 1997. As part of the renovation all the degreasing units were removed and all recessed floor portions were brought to grade. The impetus for the renovation was a product line change that required replacement of all equipment in the plant other than the wastewater system (package plant) and the electrical system.

Prior to 1997, the Modine facility produced aluminum and copper heat transfer units. The manufacturing process required the cutting and mechanical expanding of aluminum and copper to bond the copper tubing with the aluminum fins. A vapor degreasing process was necessary to adequately clean (remove oil and dirt) from the various parts and assembled units prior to further processing. The vapor degreasers at the facility used TCE until Modine purchased the facility in 1990. Modine used 1,1,1-trichloroethane (1,1,1-TCA) in the vapor degreasers from 1990 until 1993. In 1993, 1,1,1-TCA was replaced with methylene chloride, which remained the solvent of choice until 1997 when all degreasers were removed.

Since 1997, the facility has produced radiators (larger heat transfer units) using a different manufacturing process, which requires the bonding of aluminum-to-aluminum by a brazing process. No chlorinated vapor degreasing is used in the cleaning of the radiators since these units and parts can be cleaned using aqueous-based alkali cleaners.

1.3 Regulatory History

A Resource Conservation and Recovery Act (RCRA) Part A Permit application to operate a storage facility was submitted to the U.S. Environmental Protection Agency by Sundstrand Corp. (now Hamilton-Sundstrand) in 1980. Revisions to the Part A were filed in 1983 and 1990. A RCRA Part B Permit application was never filed; therefore, the facility was operated as a treatment, storage, or disposal (TSD) facility under interim status.

Prior to the purchase of the site by Modine, Sundstrand submitted a Closure Plan in September 1990 to terminate its interim status as a TSD and hold generator status only. The Closure Plan addressed three former storage areas, all located on the west side of the building. In March 1992, Modine submitted a Revised Closure Plan. The MDNR approved the Closure Plan with modifications in November 1992.

Concurrent with the RCRA activities, the Superfund Section of the MDNR Hazardous Waste Program (HWP) contracted Jacobs Engineering Group through USEPA Region VII to conduct a visual site inspection (VSI) and preliminary assessment (PA) of the facility in 1992. The VSI/PA identified 35 RCRA regulated solid waste management units (SWMUs) and four areas of concern (AOCs). Of these units, only six SWMUs were recommended for further investigation (Figure 3). These consisted of:

- SWMU 1 (Hulett Lagoon),
- SWMU 2 (Mudpits),
- SWMU 4 (Tank and Drum Storage Area 1),
- SWMU 5 (Tank and Drum Storage Area 2),
- SWMU 19 (Monorail Vapor Degreaser and Still M185)
- SWMU 31 (Tank and Drum Storage Area 3),

Several investigations and remedial activities were conducted related to these SWMUs over the years from 1992 through 2005. Section 3 of this report provides detailed discussions of these investigations. Also during this period (1998), TCE was detected in the City of Camdenton's Mulberry Well at concentrations in excess of the maximum contaminant level (MCL) of 5 micrograms per liter (ug/L). The Mulberry Well is located approximately 600 feet east-southeast of Modine facility and approximately 1,000 feet south of the former Hulett Lagoon.

Modine and the MDNR negotiated a Corrective Action Order on Consent (AOC) in July 1999 to further facilitate the investigation and remedial activities at the site. The soil investigation and remediation along with the groundwater investigation are being jointly addressed by Modine, under the AOC, and by Hamilton Sundstrand. All current groundwater investigations are being addressed by Hamilton Sundstrand under a letter of agreement with MDNR as part of the Cooperative Program.

2. Geologic Setting

2.1 Topography

Modine is located on an east - west trending ridge top in the northwestern portion of the Salem Plateau, which is a subdivision of the Ozark Plateau. The topography of the area and region is undulating, and characterized by a non-glaciated terrace with deeply incised ephemeral streams. Elevation at the site is approximately 960 feet above mean sea level with a topographic relief of 20 feet, across the site. The elevation drops off quickly into the ravine immediately south of the facility. The base of the ravine is approximately 195 feet lower than the elevation of the facility.

2.2 Soil

The Modine site was leveled for construction of the original building and subsequent additions with 5 to 15 feet of clay fill, gravel and construction debris. The fill is deepest in the southwestern portion of the site. The first natural material beneath the fill is the Roubidoux Formation residuum. The upper portion of the Roubidoux residuum consists of silty, sandy, red clay containing chert fragments. The lower portion of the Roubidoux residuum contains relatively insoluble relict sandstone, chert beds, and residual clay, resultant from the deep weathering of the Roubidoux Formation. Soil borings and excavations conducted at the site indicate that the thickness of the unconsolidated overburden is approximately 5 to 30 feet to as much as 50 feet on the extreme southwest portion of the facility grounds.

2.3 Bedrock Stratigraphy

The uppermost bedrock is the Ordovician Age Roubidoux Formation. The Roubidoux Formation consists of dolomite, sandy dolomite and sandstone. Due to extensive weathering and dissolution of the carbonate portions of the Roubidoux Formation, the bedrock surface is uneven and only isolated erosional remnants are found to exist beneath the site.

The first competent bedrock to exist below the site is the Gasconade Dolomite. The Gasconade is a cherty dolomite estimated to be approximately 300 feet thick. The Gunter Sandstone member forms the basal unit of the Gasconade. The Gunter Sandstone member separates the Cambrian and Ordovician age strata. The Gunter is estimated to be approximately 20 feet thick in this area.

The Eminence Dolomite underlies the Gunter Sandstone. It represents the top of the Cambrian Age rocks in this area. The Eminence is predominately composed of medium to massively bedded dolomite and minor chert. The Eminence Dolomite is underlain by the Potosi Dolomite. The Potosi is a thickly bedded, medium to finely crystalline dolomite that characteristically contains an abundance of quartz druse. The Derby-Doerun Dolomite underlies the Potosi Dolomite. It consists of thin bedded dolomite, which alternates with

thin-bedded siltstones and shales. The Derby-Doerun Dolomite is the deepest rock formation logged in local wells. Underlying the Derby-Doerun Dolomite are the shaley Davis Formation, the Bonneterre Formation and the Lamotte Formation. The entire Cambrian section is estimated to be greater than 1,150 feet thick.

2.4 Hydrogeology

Regional Hydrogeology

The principal potable aquifer in the Camdenton area is the Ozark Aquifer. The Ozark Aquifer consists of all bedrock units beneath the site that are located above the Derby-Doerun Dolomite. The total thickness of the aquifer is approximately 950 feet .

The Gunter Sandstone yields an adequate supply of good quality water for domestic use. Therefore, most private wells in the area are completed in this unit and do not penetrate the underlying Cambrian Formations. The major sources of municipal drinking water in the area, including the City of Camdenton municipal wells, are completed in the Cambrian age Eminence and Potosi Dolomites.

Site-Specific Hydrogeology

Shallow, non-potable groundwater occurs sporadically during the wetter months within the unconsolidated overburden atop the bedrock surface. Based on results from investigations at and around the site, the first encounter of sustainable groundwater is deep within the underlying bedrock. Two distinct groundwater zones have been identified at the site: a "perched" zone and a "deep" aquifer zone. Groundwater within both zones occur primarily within secondary porosity features (i.e. fractures, bedding plane separations, and dissolution cavities).

Groundwater within the "perched" zone system occurs at elevation depths between 817 and 828 feet above mean sea level. Saturated thickness of the "perched" zone ranges between approximately 1 and 8 feet, and appears to be controlled by the surface configuration of the low permeability zone that forms the base of the "perched" zone. The general flow direction also appears to be influenced by the occurrence, depth, and slope of the low permeability zone. Groundwater flow in the "perched" zone is generally from northeast to southwest across the site. The low permeability zone is breached by erosion in the ravines south and west of the facility. The "deep" aquifer system is separated from the overlying "perched" zone by an argillaceous interval (low permeability layer) that typically ranges in thickness between 30 and 40 feet. Groundwater within the "deep" aquifer system occurs at approximately 781 to 792 feet above mean sea level, which is approximately 200 feet below ground surface. The general groundwater flow direction in the "deep" aquifer is from east to west.

3. Investigative and Remedial Action History

Several investigations were conducted over the years (1992 through 2005) to assess the potential for releases from the SWMUs recommended for further investigation during the VSI/PA. In some cases, subsequent remedial actions were implemented in response to the investigation results and associated identified contamination.

According to the Jacobs VSI/PA, the SWMUs that required further investigation in 1992 consisted of:

- SWMU 1 (Hulett Lagoon),
- SWMU 2 (Mudpits),
- SWMU 4 (Drum Storage Area 1),
- SWMU 5 (Drum Storage Area 2),
- SWMU 19 (Vapor Degreaser and Still M185)
- SWMU 31 (Drum Storage Area 3)

The Vapor Degreaser and Still M185 (SWMU 19) was destroyed by a fire in July 1972. This unit was located within the oldest portion of the building near the west wall. As such, the potential for a release from this unit that could affect soil or groundwater is minimal. The heat of the fire would have rapidly volatilized any release.

Most of the remaining SWMUs can be grouped together by area for discussion purposes and in fact were investigated and/or remediated as a combined area containing one or more SWMUs. The Hulett Lagoon (SWMU 1) and associated City owned wastewater conveyance lines are located off the Modine facility site. The former Hulett Lagoon is located approximately 1,000 feet northeast of the Modine facility. The Mudpits (SWMU 2), Drum Storage Area 1 (SWMU 4) and Drum Storage Area 2 (SWMU 5) are all located on the west side of the Modine building and are grouped together for discussion purposes. Drum Storage Area 3 (SWMU 31) was located along the south wall of the building prior to the 1983 expansion. Following that expansion, the Monorail Vapor Degreaser and Still M567 (SWMU 26) was located in the same area. Therefore, Drum Storage Area 3 (SWMU 31) and the former Monorail Vapor Degreaser (SWMU 26) are co-located in an area of interest currently located beneath the building floor.

The following sections discuss, by SWMU or groups of SWMUs, which areas with contaminants in soil have been addressed by past investigations and remedial activities. Investigative activities related to groundwater are discussed separately.

3.1 Off-site Areas

3.1.1 Former Hulett Lagoon (SWMU 1)

The City of Camdenton operated five lagoons for the treatment of wastewater and sewage prior to the construction of the City's Publicly Owned Treatment Works (POTW). One of

these lagoons, Lagoon #3, referred to as the Hulett Lagoon was located approximately 1,000 feet northeast of the Modine facility in a mixed residential/commercial area of Camdenton. The former Hulett lagoon was constructed in 1961 and operated by the city until its MDNR-approved closure in late 1989. The lagoon occupied an area of approximately 1 acre and was constructed with 15 feet high walls of existing and imported clay.

The former lagoon received storm water, domestic sewage, and wastewater from the former Sundstrand facility, other commercial waste streams (Ron Hulett car dealership) and domestic sewage from the surrounding residential area. Wastewater was delivered to the lagoon via a City owned and operated sewer system and discharged from the lagoon to an intermittent drainage-way north of the former lagoon in accordance with an NPDES permit issued by the MDNR. No separate, dedicated wastewater line existed from the former Sundstrand facility to the Hulett lagoon at any time during the operational life of the lagoon. The NPDES permit was terminated following closure of the former lagoon. Wastewater contribution to the Hulett Lagoon from the former Sundstrand facility was collected via a series of mudpits along the west side of the building, discussed under Section 3.2.3 of this report, prior to discharge to the City wastewater sewer system.

Closure

In July 1989, Missouri Engineering Corporation (MEC), a contractor to the City of Camdenton, coordinated the removal of sludge from the former lagoon. The sludge was land applied on a 22-acre tract at the municipal airport located south of the City. Following removal of the sludge, the inlet and outlet structures were removed and the sidewalls graded to fill the lagoon.

Prior to land application, samples of the sludge were analyzed for metals but not for VOCs. Though the closure and the land application of sludges was approved by MDNR, they have subsequently stated that the "closure did not, and was not designed, to meet the substantive requirements of RCRA, relative to closure" (MDNR 1999).

Investigations

Following the discovery of low levels of TCE in two monitoring wells installed by MDNR on the Modine property, several investigations at the former lagoon were undertaken to assess the potential for soil contamination from VOCs. Figure 4 illustrates the locations where soil samples were collected during the MDNR and SECOR investigations. Each investigation is discussed in the following paragraphs.

1996

Dames & Moore, a consultant acting on behalf of Modine, conducted a subsurface investigation at the former Hulett Lagoon in October 1996. The purpose of the investigation was to determine the presence or absence of VOCs, in particular TCE, in soil at the former Hulett Lagoon. Four hydraulically driven probes were advanced in the area of the lagoon where the inlet pipe from the City sewer system and the outlet or discharge pipe from the lagoon were reportedly previously located.

TCE was the only VOC present at concentrations in excess of the current MDNR Cleanup Levels for Missouri (CALM) Soil Target Concentration (STARC) Leaching to Groundwater Pathway (C_{LEACH}), and the Site-Specific Cleanup Goals (SSCG) developed by Modine with

the approval by the MDNR in February 2002. These results were in soil samples from two of the four probes; one located near the outfall and the other near the center of the former lagoon.

1999

In January 1999, the MDNR Superfund Section conducted a Preliminary Assessment/ Site Inspection (PA/SI) of the former lagoon. A membrane interface probe (MIP) was used to generate soil gas data of the subsurface within and surrounding the boundaries of the former lagoon area. The MIP results showed no significant detections of VOC in any of the borings.

The MDNR also advanced 10 soil borings and collected eight soil grab samples from the lagoon area and one background sample from outside the lagoon. Soil samples were analyzed for total metals and VOCs. Three samples, collected near the previous location of the outfall pipe, contained TCE at concentrations above the CALM C_{LEACH} value for TCE. However, only one of these soil samples was found in excess of the SSCG.

2000

SECOR, a consultant acting on behalf of Hamilton Sundstrand, conducted a soil investigation at the former lagoon in June 2000 as part of the first phase of the CERCLA Remedial Investigation (RI). A total of 15 soil borings were advanced within the footprint of the former lagoon. All of the borings were located within previously uninvestigated portions of the former lagoon (central and eastern portions). Borings were advanced until meeting refusal within the upper (weathered) portion of the underlying dolomite bedrock at depths ranging between 4 and 11 feet below ground surface (bgs).

Soil samples were analyzed in the field for TCE using a field gas chromatograph (GC) to aid in assessment of extent. Confirmation soil samples were collected from each probe and analyzed for VOCs and RCRA metals. TCE and cis-1,2-DCE were detected above CALM C_{LEACH} levels in one soil sample submitted from a boring located along the former west side of the lagoon, nearest the MDNR sample locations. Only one sample contained a concentration that exceeded the SSCG value for TCE (Table 1).

The samples exhibiting the greatest VOC concentrations were also submitted for Toxicity Characteristic Leaching Procedure (TCLP) analysis. No VOC concentrations were found above the detection limits in the TCLP extract.

Conclusion

Sediment/sludge was removed during closure of the lagoon in 1989. The sludge was not tested to determine VOC concentrations, if any, prior to land applying the sludge on airport property. Investigations to assess residual VOC concentrations in soil at the former lagoon revealed isolated areas with TCE concentrations above the SSCG, predominantly around the outlet pipe. Though these concentrations exceeded the calculated SSCG, TCLP results showed no detectable concentrations.

The TCLP extraction is more aggressive and less representative of naturally occurring leaching conditions than the Synthetic Precipitation Leaching Procedure (SPLP) used to calculate the SSCGs. The aggressive nature of the TCLP extraction would result in greater concentrations of VOCs in the leachate than would occur in a natural setting (the intent of

SPLP is to replicate natural conditions). Therefore, the TCLP results show residual soil contamination at the former Hulett Lagoon does not pose a risk to groundwater from leaching. In addition, based on the depth of the samples (6 to 9 feet below ground surface) SECOR concluded that residual soil contamination at the lagoon does not pose significant risk to human health or the environment via direct contact, ingestion or inhalation. MDNR acceptance of the RI provided concurrence with the conclusion that no risk is posed by residual soil contamination at the former Hulett lagoon.

3.1.2 City Owned Domestic Wastewater Line

In accordance with 40 CFR §261.4(a)(1)(i) (domestic sewer exemption), the City owned and operated sewer line that conveyed wastewater from the facility to the former Hulett Lagoon is exempt from the RCRA corrective action process as defined in the AOC. However, the MDNR has expressed concern with regard to potential sources of VOCs in soil along the former domestic wastewater line.

There has been no direct sampling of soil surrounding the off-site City owned wastewater conveyance piping. However, a dye trace study of the City owned sewer line completed in 1998 by MDNR, showed that the City sewer line has leaks in it and that the movement of any wastewater leaking from the line moves quickly to the "perched" zone. Dye injected in the sewer line was observed in well MW-4 within four days of injection.

Conclusion

Since the wastewater line that was connected to the Hulett lagoon is City owned and operated, it is not covered under the AOC for Modine. In addition, the continual flushing action of the leaking line would result in no significant concentrations of VOCs remaining along the line. Therefore, no further investigation needs to be completed for this area.

3.2 West Side of the Building

The area west of the building containing a truck lane, a parking lot and lay down areas has been investigated over several phases of work beginning in 1991 and culminating in the removal of significant volumes of VOC-impacted soil in 2002. The following text describes the activities and actions associated with this area.

3.2.1 Drum Storage Area 1 (SWMU 4) and Drum Storage Area 2 (SWMU 5)

Drum Storage Area 1 was located approximately 80 feet west of the west wall of the current facility's mechanical room. Drum Storage Area 1 was operational from 1972 to 1983 and was an area approximately 25 feet by 30 feet in size. Up to 45 drums of liquid waste and sludge were stored in the area at any given time. Waste stored included TCE still bottoms, waste paint filters and waste paint liquid, and non-hazardous waste oil. Drum Storage Area 1 corresponds with "Area 1: 1972 – 1983 Drum Storage Area" as defined in the RCRA Closure Plan.

Drum Storage Area 2 was located approximately 10 feet west of the west wall of the building in an area currently under the wastewater pretreatment plant. Drum Storage Area 2 was operational from 1983 through 1985. The storage area was constructed of a concrete slab (25 by 30 feet) with an 8-inch concrete containing curb for secondary containment. In

addition to drum storage, this area also contained a 1,000-gallon capacity waste oil tank and a 5,300- gallon tank used to store TCE still bottom waste. Drum Storage Area 2 corresponds with "Area 2: 1983 – 1985 Drum Storage Area" as defined in the RCRA Closure Plan.

Investigations

1991

The first investigation along the west side of the building was the 1991 Environmental Site Assessment (ESA) conducted by Law Environmental, Inc (Law) under contract to Modine. A portion of the ESA investigation focused on what was identified as "Area 2, a drum storage area located along the west wall (side) of the plant". Four borings were advanced, two approximately 30 to 40 feet west of the plant building, one near the former location of a surface water drainage feature and one along the assumed location of a buried stormwater drain line. Figure 5 illustrates the location of these borings.

Analytical results from soil samples collected from the borings indicated only low levels of VOCs. The highest measured TCE and vinyl chloride concentrations, 0.061 and 0.078 mg/kg respectively, are well below the SSCG for each constituent (Table 2).

1993

Based on the results of this investigation, Law was contracted to conduct a follow-up investigation in July 1993. Six soil borings (Figure 5) were advanced and soil samples collected from within the area of the former drum storage area, to further assess the presence of VOCs, metals, and cyanide in soil. An additional background soil boring was advanced near the northeast corner of the Modine property. A lead concentration in excess of the Any-use Soil Level (ASL), the screening levels in use at that time, was the only constituent identified above regulatory levels. The elevated lead concentration was found in one boring (B-11) located immediately south of the wastewater pretreatment area that overlies former Drum Storage Area 2.

1994

In 1994, Law performed a Risk Assessment to evaluate the risk posed from VOCs and lead in the former Drum Storage Area. The Risk Assessment concluded that no health risk was posed by the minimal amounts of VOCs in soil and that lead in soil was not considered a significant health risk.

Conclusion

The concentrations of VOCs identified by the Law investigations are well below the SSCG for the site and, coupled with the Risk Assessment; show that no further action, investigative or remedial, needs to be taken for these SWMUs and the surrounding area. However, the MDNR HWP requires that the extent of impact be defined to non-detectable levels for closure of TSD facilities. Therefore, an additional investigation (described in Section 3.2.2) was undertaken.

3.2.2 Investigation to Achieve Final Closure of the Interim RCRA TSD Facility

In 1995, Dames & Moore, under contract to Modine, conducted an Investigation to Achieve Final Closure of the Interim RCRA TSD Facility. The study included both an investigation to assess the extent of VOCs in the area of the former drum storage areas on the west side of

the building and the remediation of the elevated lead level identified near boring B-11 by Law in 1993. A groundwater investigation was also part of this study and is discussed in Section 3.4 Groundwater.

Investigation

Six soil borings were advanced in an effort to define the lateral and vertical extent of the low VOC concentrations identified by Law (Figure 5). The only VOC concentration identified in excess of the current C_{LEACH} level was found in a soil sample from Boring B-13 located along the former buried stormwater drain line along the west side of the building. The soil sample collected from directly above bedrock, at a depth of 13 feet bgs exhibited TCE at 204 mg/kg and tetrachloroethene (PCE) at 2.18 mg/kg (Table 3).

Remedial Action

The elevated lead concentration was present in the upper two feet of the soil horizon, therefore the excavation extended to only a depth of three feet below ground surface. Excavation limits are depicted on Figure 5. Approximately 12 cubic yards of soil were removed and, following characterization, disposed of off-site as a special waste. All confirmation samples from the floors and walls of the excavation contained lead concentrations at or below 90 mg/kg; well below the ASL of 240 mg/kg and the background concentration of 238 mg/kg obtained from the soil samples collected in the background boring installed by Law.

Conclusion

Both of the borings that were located down surface gradient from and most distant from the former drum storage areas contained low levels of VOCs and therefore did not define the extent of the contamination. Further investigation was determined to be needed. These further investigations and the resultant remedial actions are addressed in the following sections (Section 3.2.3. through Section 3.2.6).

3.2.3 Mudpits (SWMU 2)

The mudpits along the west side of the building were used for wastewater collection from the time of building construction in 1967 through 1986, when the wastewater pretreatment plant was constructed. There were originally four mudpits, identified as numbers 1 – 4 from north to south (Figure 6). Mudpit #2 was removed during construction of the wastewater plant.

The mudpits were concrete sumps, each one a cube with dimensions of four feet to a side, located approximately ten feet west of the building foundation. The mudpits received storm water, boiler blowdown, and cleaning line water from the manufacturing process. The mudpits were connected by a 6-inch diameter steel line and each pit received wastewater from the previous pit starting at the south (#4) and discharging to the on-site sewer line at the north (#1).

Investigation

An investigation to assess any potential releases from the mudpits was conducted in September 1997. Ten soil probes were advanced adjacent to the mudpits and the sewer line discharging to the north.

Results from the sampling showed no VOC concentration in excess of the ASLs, the screening levels at that time. However as pointed out in the MDNR CME, TCE concentrations in soil samples from the four probes did exceed the C_{LEACH} level. When TCE results were compared to the SSCG, developed with the approval of MDNR in February 2002, only one soil sample contained VOCs in excess of the SSCG (Table 4). The boring from which the soil sample was collected was located between pits #3 and #4.

Lead was found above the corresponding ASL at three probe locations near pit #1 and pit #3 and along the discharge line to the north of pit #1. Based on the lead results, over excavation was recommended during the planned removal of the out-of–service mudpits.

Remedial Action

As a remedial action in response to the investigation data, Mudpits #1, #3, and #4 and the area surrounding the former probe location along the discharge line at the north end of Mudpit #1 were excavated in October 1997. Figure 6 illustrates the limits of the excavations.

Confirmation samples from the mudpit excavation walls and floor showed that VOCs and metals were below the respective ASL for all samples other than in the area of mudpit #3. Lead was present above the ASL in each wall and the floor sample from this excavation. Additional excavation was not possible due to underground obstructions. Subsequent excavations at the facility have revealed the occurrence of galena, a lead ore mineral, within the soil horizon. Therefore, it is now assumed that the elevated lead levels observed in this area are naturally occurring.

A comparison of the VOC confirmation data with the SSCG illustrates that six confirmation soil samples contained TCE at concentrations above the SSCG. Of these six sample locations, three were removed through subsequent excavations. Two of the remaining three locations were from the base of the excavations of Mudpit #1 and #4 with TCE concentrations of 0.925 mg/kg and 0.383 mg/kg, respectively. The final "above criteria" sample was located in the east wall of the Mudpit #4 excavation, which corresponds to the west wall of the Modine building. The TCE concentration in this sample was 1.975 mg/kg (Table 4).

Conclusion

The areas in which VOCs exceed the SSCGs are limited and isolated, and in areas that are inaccessible for removal due to underground structures (fire line, etc.) or the potential to undermine the building foundation. Therefore, no further action can be taken to remove and/or remediate these isolated areas.

3.2.4 On-site Wastewater Discharge Line

The on-site wastewater discharge line conveyed wastewater from the former mud pits on the west side of the building to the City of Camdenton sewer system located along the north side of the Modine facility. The discharge line was removed and replaced as part of a plant renovation in July 2000. Soil samples from the base and the walls of the excavated trench

were collected for internal documentation purposes. This information was later provided to the MDNR in a letter report dated February 13, 2003.

Remedial Action

The portion of the discharge line removed and replaced consisted of a north-south segment and an east-west segment (Figure 7). Excavated soil was used as backfill on site and the waste discharge line debris (drain tiles and other excavation material) were treated as a special waste and disposed of properly.

Twelve composite soil samples were collected from both the floor and walls of the excavated trenches and one sample from the floor beneath a 90 degree elbow, resulting in a total of 25 soil samples. These samples were analyzed for VOCs and metals. One sample of released material, identified as sediment, was collected from each of the north-south and east-west segments of the line.

With the exception of methylene chloride detected in two sediment samples, VOCs were detected in soil samples at concentrations well below the respective CALM C_{LEACH} screening levels, and therefore below the SSCGs (Table 5). Methylene chloride was also present in the associated laboratory blank. Therefore, the methylene chloride concentrations reported in the samples are assumed to be attributable to contamination introduced at the laboratory.

All metals were below CALM C_{LEACH} levels with the exception of chromium and lead. The chromium detected at elevated concentrations in both sediment samples suggests that the source of the chromium in the sediment samples was likely associated with past manufacturing processes at the facility. However, chromium concentrations in soil only exceeded the CALM C_{LEACH} level in three samples – two locations nearest to the former mudpits and the other near a sediment release.

Lead was detected in five soil samples at concentrations that exceeded the CALM C_{LEACH} screening level. Elevated concentrations of lead were not identified in the sediment samples. Lead is a naturally occurring metal commonly found in native southern Missouri soils. The lead bearing mineral - galena - was observed at the soil/bedrock interface during subsequent removal actions conducted at the Modine facility. Therefore, it appears that lead concentrations in excess of screening levels are natural occurrences and not associated with past manufacturing processes at the facility.

Conclusion

During the investigation, the identified VOCs in residual soils were below CALM and SSCG levels. Chromium concentrations remaining in place are only slightly above the C_{LEACH} level and the sediment was removed and disposed of properly.

Therefore, it appears very unlikely that the VOC and metal concentrations observed in soil are a contributing source to groundwater contamination beneath the site. No further action, investigative or remedial, is required for this area.

3.2.5 West Side Delineation

CH2M HILL was contracted to conduct an investigation for the purpose of defining the lateral extent of TCE contamination in soil surrounding former boring B-13 located near the

end of the former stormwater drain line (refer to section 3.2.2). It should be noted that the location of B-13 was never surveyed as part of the original investigation.

Investigation - Phase 1

Four direct push soil probes were advanced during the October 2000 investigation (Figure 8). Three probes were advanced around the boring B-13, each roughly 15 feet away from the original boring. The fourth probe was advanced in the immediate vicinity of boring B-13

In addition to the TCE and PCE previously identified in this area in 1995, the following VOCs were present at concentrations exceeding their respective CALM C_{LEACH} levels: 1,1-dichloroethene (1,1-DCE), cis-1,2-dichloroethene (cis-1,2-DCE), methylene chloride, vinyl chloride, and 1,1,2-trichloroethane (1,1,2-TCA). The greatest concentrations reported were TCE at 220 mg/kg, cis-1,2-DCE at 30 mg/kg and vinyl chloride at 1.8 mg/kg (Table 6). Further investigation was recommended based on the Phase 1 results.

Investigation - Phase 2

Eight direct push soil probes were advanced during the December 2000 investigation. Seven probes were advanced around the October borings, each roughly 15 to 20 feet away from the original borings. The eighth probe was advanced down gradient of the area of interest. Boring locations are identified in Figure 8.

The results indicated that vinyl chloride exceeded the C_{LEACH} level in each of the eight new borings and cis-1,2 DCE exceeded the C_{LEACH} level in four of the borings (Table 6). No TCE concentrations were found in excess of the C_{LEACH} screening level. The highest vinyl chloride concentration reported was an estimated value of 12 mg/kg.

Conclusion

The lateral extent of the chlorinated VOC impact to soil in the area of interest near the former boring B-13, was reasonably well defined after the October and December 2000 investigations. The extent of contamination covered an area estimated to encompass approximately 4,000 square feet. Remediation activities were determined to be the next step for this area.

3.2.6 West Side Corrective Action

An approved Corrective Action Work Plan was submitted by CH2M HILL on behalf of Modine to the MDNR in September 2001. The corrective action consisted of the excavation of soil impacted by VOCs in excess of C_{LEACH} levels on the west side of the Modine building based on the previous Phase 1 and 2 investigation results.

Remedial Action – Part 1

Excavation activities began in October 2001 with the excavation, segregation, and stockpiling of approximately 4,800 cubic yards of soil. The volume of excavated and stockpiled soil exceeding C_{LEACH} levels was estimated at 3,000 cubic yards.

As excavation activities progressed and more information regarding the historic handling of chlorinated solvents at the facility became available, it became apparent that the volume of impacted soil was significantly more than originally estimated. This was particularly true

laterally to the east and southeast of the assumed area of impact. Therefore, excavation activities ceased and a direct-push subsurface investigation was conducted in order to better understand and define the extent of impacted soil.

Delineation Investigation

Thirty-four direct-push soil probes were advanced in November 2001 (Figure 9). Thirty soil probes were placed in areas north, east, and south of the previously excavated area and four soil probes were placed in the parking lot area located north of the excavated area. Each boring was advanced until probe refusal (bedrock) was encountered. Borings were generally placed approximately 20 feet or more from areas of known impact identified during the excavation activities.

If field results (photoionization detector [PID] readings, odor, discoloration, etc.) indicated that a boring was located within impacted soil, that location was again offset (typically by 20 feet) until the lateral extent was presumably defined. Soil samples were collected at depths near the soil/bedrock interface from locations where field-screening results indicated minimal impact. Soil samples were analyzed for VOCs. No samples were collected from borings with obvious impact since the purpose of the investigation was to delineate extent.

Results

The results of the subsurface investigation indicated that a significant volume of soil contained concentrations of vinyl chloride and cis-1,2-DCE that slightly exceeded C_{LEACH} levels (Table 7). However, the vinyl chloride and cis-1,2-DCE did not appear to be leaching into the underlying groundwater since neither vinyl chloride or cis-1,2-DCE were present in groundwater samples collected from nearby on-site monitoring wells at levels exceeding CALM Groundwater Target Concentrations (GTARC).

Based on these facts, the development of alternative site-specific soil cleanup goals was considered appropriate. In accordance with guidance provided in Appendix C-Tier 2 Cleanup Levels of CALM, the Synthetic Precipitation Leaching Procedure (SPLP) analysis of soil samples was used to determine a site-specific leaching potential of VOCs to the underlying groundwater.

Through comparison of the total and SPLP VOC results, site specific total VOC residual concentrations of cis-1,2-DCE, TCE, and vinyl chloride in the on-site soil were determined. The site-specific cleanup goals (SSCG) determined were 8.68 mg/kg cis-1,2-DCE, 0.38 mg/kg TCE, and 0.32 mg/kg vinyl chloride.

Remedial Action – Part 2

A Corrective Action Work Plan Addendum 2 addressing the new cleanup levels and excavation activities was submitted and approved by the MDNR in May 2002. Excavation of the impacted soil began at the east wall of the area previously excavated in October and November 2001 and was advanced in an easterly direction to the assumed excavation limits identified in the Work Plan. Excavation of the impacted unconsolidated overburden continued until field screening (PID, odors, discoloration, etc.) indicated minimal VOC contamination existed or bedrock was encountered.

Approximately 4,614 tons of VOC impacted soil was removed and transported to Allied Waste's Jefferson City, Missouri landfill as special waste. Approximately 1,900 cubic yards

of non-impacted soil and asphalt were excavated, segregated, and stockpiled in the southwest corner of the lower parking lot for future use as backfill.

With the exception of the northwest corner, the extreme southeast corner, and the east central area, the final excavation limits were generally similar to the presumed excavation limits identified in the Corrective Action Work Plan Addendum 2 (Figure 10). The volume of additional VOC impacted soil removed from the extreme southeast and east central excavation areas was approximately 50 cubic yards and 100 cubic yards, respectively.

During the excavation of the presumed northwest limits of the identified area, it was discovered that the extent of contaminated soil extended further north and east than anticipated. A large tree stump and two underground drain pipes (existing 16-inch and former eight-inch storm sewer drain pipes) were uncovered in this area. Approximately 870 cubic yards of impacted soil were removed and disposed of properly. Figure 10 depicts the limits of the excavation.

Results

Confirmation samples were collected at approximate 10 linear foot intervals along the exposed excavation walls. A total of 53 confirmatory samples (49 field samples and four duplicate samples) were collected from the excavation area's walls. No confirmation samples were collected from the base of the excavation, since soils were removed down to the bedrock surface.

All final confirmation samples showed that TCE, cis-1,2-DCE, and vinyl chloride concentration were below the SSCG (Table 8).

Conclusion

The confirmation soil sample analytical results demonstrate that all impacted overburden with VOC concentrations exceeding site-specific cleanup goals was removed and disposed of properly. No further action, investigative or remedial, is required for the soil source areas on the west side of the Modine building. MDNR concurred with this conclusion via letter dated June 30, 2004.

3.3 Beneath the Building Floor

Several investigations, including the collection of soil samples from beneath the floor and water samples from the gravel subgrade, have taken place over the years. Each investigation is discussed in the following sections.

3.3.1 Drum Storage Area 3 (SWMU 31) and Monorail Vapor Degreaser and Still M567 (SWMU 26)

Drum Storage Area 3 was reportedly operational from 1979 through 1983 (Jacobs). It was located along the south outside wall of the building. The storage area was removed in 1983 to accommodate a building expansion to the south. The Jacobs VSI/PA reports that Drum Storage Area 3 was constructed of a concrete slab over a base rock and clay mixture. It was reportedly 25 feet wide by 50 feet long. The VSI/PA reported that waste managed in this area consisted of waste TCE and waste oil from degreasing operations, stored in 55-gallon

drums. A release of TCE from 15 corroded drums reportedly occurred at Drum Storage Area 3.

This area **does not** correspond with "Area 3: 1985 – 1990 Drum Storage Area" as defined in the RCRA Closure Plan. Area 3 in the Closure Plan refers to the Drum Storage Area located within the wastewater pretreatment plant building.

Modine contends that this area was never used as a drum storage area for waste solvents, but instead was used for storage of old equipment. However, MDNR received a report from a former employee that a 4,500-gallon release of spent solvent occurred in this area. Modine continued to investigate this reported release and obtained testimony from long time employees that indicated the release was not a solvent release. The released material was reportedly a neutralizing compound composed of water and soda ash. The neutralizing compound was used to clean out solvent tanks and vapor degreasers after the solvent had been removed.

Monorail vapor degreaser and still M567 was the largest vapor degreaser at the facility. It was installed in 1985 and remained in service until 1997. The unit had a solvent capacity of 4,000 gallons. The floor beneath the monorail vapor degreaser was recessed approximately 5.5 feet below the plant floor surface. The recessed trough was approximately 65 feet long (east to west) and 10 feet wide. The degreaser unit measured approximately 50 feet long. TCE was used in the unit from 1985 until Modine purchased the facility in 1990. Modine used 1,1,1-trichloroethane (1,1,1-TCA) in the vapor degreaser from 1990 until 1993. In 1993, 1,1,1-TCA was replaced with methylene chloride, which was used until 1997 when the monorail vapor degreaser was removed.

Investigations

1991

The first investigation conducted in the area of the drum storage area and the monorail degreaser was the 1991 ESA conducted by Law. A portion of the ESA investigation focused on what was identified as "Area 1, drum storage area south of the building wall where MDNR has suggested a 4,500 gallon solvent release occurred". Five holes were drilled through the concrete floor and hand-augered borings advanced, two of which were located within the monorail vapor degreaser trough (Figure 11).

Soil samples collected contained a variety of VOCs, however, only TCE concentrations were present in excess of the SSCG of 0.38 mg/kg. TCE concentrations exceed the SSCG in the soil samples from the boring adjacent to the solvent tank (3.0 mg/kg) and at the east end of the degreaser trough (0.78 mg/kg). The 1,1,1-trichloroethane concentration of 200 mg/kg in the soil sample from the east end of the trough exceeded the C_{LEACH} concentration of 3.5 mg/kg (Table 9).

1997

In April 1997, Modine contracted Dames & Moore to advance ten soil probes in this area (Figure 11). The probes were located on all sides of the trough and associated storage tank. The depths of the Geoprobe® ranged from approximately 3.5 to 17 feet bgs.

Soil analytical results indicated the highest VOC concentration in samples collected from probe P-7, located approximately seven feet east of the above ground solvent storage tank

and approximately three feet north of the trough for the monorail vapor degreaser. TCE concentrations of 4 and 3.4 mg/kg were found in the two samples collected from probe P-7, covering a sampled interval of 4 to 5.5 feet bgs, exceeded the SSCG of 0.38 mg/kg. Two other VOCs , 1,1,1-TCA and methylene chloride were found at concentrations in excess of the C_{LEACH} values. The sample from 4.5 to 5.5 feet bgs in probe P-7 contained 1,1,1-TCA at 6.0 mg/kg, above the C_{LEACH} level of 3.5 mg/kg. Methylene chloride was reported at concentrations above the C_{LEACH} level of 0.02 mg/kg in probes P-5, P-6, P-7, P-9 and P-10. Methylene chloride was also present in the laboratory blank in all samples showing concentration in excess of C_{LEACH} levels other than the two samples collected from probe P-5 (Table 9).

As part of the previous investigation in 1991, Law had installed an access port in the floor of the base of the degreaser trough for collecting water trapped within the gravel subgrade beneath the floor. A sample of the trapped water was collected from the access port and from probe P-9 as part of this investigation.

The analytical results from the trapped water samples indicated the presence of several VOCs. The trapped water from the access port contained methylene chloride; 1,1-DCE; 1,2-DCA; 1,1,1-TCA; and TCE at concentrations greater than the GTARC. The trapped water from probe P-9 also contained concentrations of methylene chloride; 1,1-DCE; 1,1,1-TCA; and TCE at concentrations greater than the GTARC. The concentrations in water samples collected from the access port were 1 to 2 orders of magnitude greater than concentrations found in the trapped water samples from probe P-9.

Conclusions

The results from the soil sampling beneath the floor of the building in the area of the former monorail degreaser show that TCE was present in the soil at one location, east of the former above ground solvent storage tank location and north of the monorail vapor degreaser trough, at concentrations in excess of the calculated SSCG. Additional VOCs are also present in the soil samples surrounding the former monorail degreaser at concentrations in excess of the C_{LEACH} levels.

Samples collected from the trapped water within the gravel subgrade contained VOCs at concentrations in excess of the GTARC levels. Since the gravel subgrade in this area was removed along with the access port through the floor of the building during renovation activities later in 1997, no additional samples of trapped water were able to be collected.

The reported 4,500-gallon release of spent solvent in this area was actually a release of a neutralizing compound composed of water and soda ash used to clean out solvent tanks and vapor degreasers after the solvent had been removed.

3.3.2 Renovation Sampling

The building underwent a complete interior renovation in 1997. As part of the renovation, all the degreasing units were removed and all recessed floor areas were brought to grade. All equipment and subgrade piping in the plant was replaced with new equipment and lines at this time.

Investigation

During the renovation, Modine conducted additional sampling of soil beneath the floor of the building. Fourteen soil samples were collected for TCLP VOCs for the purposes of disposal characterization. Soil sample locations are depicted on Figure 12. As illustrated, one of these samples (#7) was collected from the area of the former monorail degreaser.

Though direct correlation of TCLP data to total VOC data is not possible, the data can demonstrate the absence of a substantial source of VOCs. A substantial source of VOCs in soil would have resulted in detectable TCLP concentration. The chlorinated TCLP VOC results from the sampling were all below detectable levels.

Conclusions

The TCLP data suggests that no substantial source of VOCs was identified in soil beneath the floor of the building affected by the renovation activities.

3.3.3 Indoor Air Quality Assessment

An indoor air quality (IAQ) assessment was conducted in March 2003 by CH2M HILL. The indoor air quality assessment was requested by MDNR, to complete an Environmental Indicator (EI) determination (Current Human Exposures Under Control) for the Modine facility. The EI program is used by the Environmental Protection Agency (EPA) to track progress at sites under the RCRA Corrective Action Program.

The MDNR was concerned that a potential pathway existed for contamination to migrate from residual VOCs in the soil beneath the building or in soil along the west side of the building to the air inside the plant. The objective of the IAQ assessment was to investigate this potential pathway and determine if unacceptable human exposure to VOCs migrating to indoor air from soil was occurring at the facility.

Investigation

Air samples were collected from six locations within the Modine facility and one outside of the facility. The sampling locations were selected in consultation with the MDNR. Air sampling locations are identified on Figure 13. Air samples were collected using 24-hour integrated canister sampling. This method involved placing an evacuated stainless steel canister in each of the sample locations. Each canister had a preset sampling flow rate, established accurately by the laboratory. After the valve was opened, the canister continuously collected an air sample over the 24-hour period until the valve was closed.

Two analytical methods were performed on each sample. USEPA Method TO-14 for volatile organic compounds provided adequately low detection limits for five of the eight constituents of concern (COCs). Selected Ion Monitoring (TO-14 SIM) was conducted for three analytes - PCE, TCE, and vinyl chloride. The SIM analysis enabled lower detection limits to be achieved for these VOCs.

Results

Low concentrations of five VOCs (TCE, PCE, cis-1,2-DCE, vinyl chloride, and methylene chloride) were detected in the indoor air samples. Concentrations of the five VOCs found during the IAQ assessment were all less than 1% of the lowest occupational exposure limit.

The concentrations in indoor air at the facility also fell below the calculated comparative screening levels for workers in an industrial setting (Table 10).

TCE and PCE were also detected at very low concentrations in the outdoor air sample. These concentrations are consistent with ambient background concentrations found in other parts of the country.

Conclusions

A comparison of measured concentrations to the most conservative occupational exposure limits and the calculated risk-based screening levels for workers in an industrial setting showed that there are no "unacceptable human exposures to contamination that can be reasonably expected under current land- and groundwater-use conditions". Therefore, the Camdenton facility achieved compliance with the Human Exposure Under Control EI.

Follow-up

During a February 6, 2004 conference call to discuss the results of the IAQ assessment and the path forward for the site, the MDNR requested that calculations be completed to support the assertion that the concentrations of VOCs, specifically TCE, found in the indoor air during sampling could be the result of concentrations left in soil on the west side of the building or beneath the building floor. The calculations were done and provided to the MDNR in a letter dated February 18, 2004 that summarizes the results of the conference call. The calculation spreadsheets were provided with the letter and are included in Appendix A of this report. The calculations demonstrate that the concentrations in soil both on the west side of the building as well as beneath the floor could account for the observed concentrations in indoor air. Projected concentrations fall within the same order of magnitude as those actually obtained.

Modine has continued to monitor the indoor air on an annual basis using NIOSH sampling and testing methods and have found no contaminant concentrations above detectable levels.

3.3.4 Chemical Inventory

During the August 16, 2005 meeting, MDNR requested that an assessment of the chemical inventory at the time the IAQ assessment was conducted be provided as part of this comprehensive report. A chemical inventory assessment will determine if any chemical products used on-site could contribute to the observed indoor air concentrations.

Results

The chemical inventory was conducted by performing a review of Material Safety Data Sheets (MSDSs) index provided by Modine. This MSDS index is provided in Appendix B.

An assessment of the information provided identified seven products as solvent cleaners or penetrants possibly containing chlorinated solvents. According to records provided by Modine, these products are no longer used at the facility, and were phased out during a period from 1989 to 2000. VOC concentrations that could potentially have been emitted from use of these products would not persist in indoor air within the facility. Therefore, it is highly unlikely that emissions from products used within the facility would have been the source for chlorinated VOCs, particularly TCE, detected in indoor air sampling.

Conclusion

Based on an assessment of the MSDS, it is highly unlikely that emissions from products used within the facility would have been the source for chlorinated VOCs, particularly TCE, detected in indoor air sampling.

3.4 Groundwater

Hamilton Sundstrand, through their consultant SECOR, has taken the lead with regard to characterization of groundwater in the area of the former Hulett lagoon and the Modine facility under the cooperative agreement with the Superfund Section of MDNR. The investigative history regarding groundwater has been well documented in the RI (2003) and Feasibility Study (2004) produced by SECOR. Therefore, the findings from previous groundwater investigations are only briefly summarized in this portion of the Comprehensive Historical Summary Document.

The locations for all monitoring wells in the area of the former lagoon and the Modine facility are illustrated on Figure 14.

MDNR Investigation

In July 1992 the MDNR HWP Superfund Section installed two monitoring wells on the Modine property (MW-1 west side, MW-2 east side), collected groundwater samples from these wells along with neighboring private wells, surface water samples from a down-gradient creek, and surface water samples from a nearby spring. No constituents were detected by MDNR in the groundwater or surface water samples. Based on the results the MDNR HWP Superfund Section decided to pursue no further action as documented in a March 2, 1993 letter to Modine.

TCE first appeared above the MCL of 5 ug/L in the onsite wells during the second MDNR sampling event in December 1994. Concentrations were only slightly in excess of the MCL (5.1 and 6.9 ug/L). TCE concentrations declined to below detectable levels in MW-2 on the east side of the building during 1995 and 1996, but remained above the MCL in MW-1 through 1995 (two sampling events).

Investigation to Achieve Final Closure of the Interim RCRA TSD Facility

Based on the MDNR results from the onsite wells, Modine installed two additional on-site wells in 1995 (MW-3 south, MW-4 north) as part of the Investigation to Achieve Final Closure of the Interim RCRA TSD Facility. Results from the sampling of these two wells indicated that the greatest concentrations were found in MW-4 located approximately 125 feet northwest of the northwest corner of the plant. TCE concentrations in this well were greater than 100 ug/L in late 1995 and early 1996.

Mulberry Well

Based on finding elevated concentrations of TCE in the onsite wells, the MDNR began sampling the nearby City of Camdenton water supply well known as the Mulberry Well. The Mulberry Well is located approximately 600 feet east-southeast of the Modine facility and approximately 1,000 feet south of the former Hulett Lagoon. The Mulberry Well was

installed in 1986, completed to a depth of about 900 feet bgs, and cased to a depth of about 400 feet bgs.

Sampling of the Mulberry Well began in January 1997 and TCE was found at a concentration below the MCL. In February 1998, TCE was detected above the MCL and GTARC of 5 ug/L. Since the beginning of 1999, the City has been sampling the well monthly. TCE concentrations have fluctuated over time with concentrations ranging from under 5 ug/L (the MCL) to greater than 50 ug/L. No other VOCs have been detected in the Mulberry Well.

Due to the level of TCE concentrations found in the Mulberry Well, it was taken off-line by the city. However, the City has continued to periodically pump the well to waste for the purposes of controlling the groundwater contaminant plume.

Fracture Survey

Dames & Moore conducted a field fracture survey on behalf of Modine in 1996. Bedrock outcrops in the erosional valleys north, south and west of the Modine facility were inspected and the strike and dip of the fractures were measured using a Brunton Compass. The orientation of 173 fractures were measured from 20 outcrop locations. The primary fracture orientation is nearly vertical and trends N 50° E. SECOR conducted a fracture survey as part of the RI (2003) and confirmed a predominate N 50° E fracture trend. Since groundwater flow within the bedrock is via these secondary porosity features, the groundwater flow is affected by the primary fracture pattern and to a lesser degree the secondary fracture pattern.

The findings from the fracture survey suggest that the former Hulett Lagoon is a source of the elevated TCE concentrations found in MW-4 on the Modine property. Therefore, monitoring well MW-5 was installed near the lagoon in August 1998.

Dye Test

A dye test was conducted in the spring and summer of 1999. The test consisted of the injection of rhodamine dye beneath the concrete foundation on the east side of the Modine plant and flourescein dye was injected into well MW-5 at the former Hulett Lagoon. Monitoring for the presence of dye was conducted at all four of the onsite wells (1-4). The purpose of injecting the rhodamine dye into the gravel subgrade beneath the building foundation was to assess the potential movement of trapped water from the gravel subgrade to groundwater. A shallow well (MW-6) screened in the unconsolidated overburden (base of the screen on the bedrock surface) was installed on the west side of the Modine building to assess if the dye would move along the bedrock surface.

Results of the test showed a hydraulic connection between well MW-5 and well MW-4, verifying the conclusions of the fracture survey. Flouresein was present in MW-4 beginning in July, peaking in August and was still detectable in the last sample collected in early September, 2005. Neither flourescein nor rhodamine was found in any of the three other on-site monitoring wells. Flourescein was detected in the Mulberry well in one of three sampling events but was determined to be suspect.

Remedial Investigation

SECOR conducted RI activities in three phases from 2000 through 2002. During the first phase five monitoring wells were installed (MW-7 through MW-11), during Phase II four wells were installed (MW-12 through MW-15), and seven wells were installed as part of the third and final phase (MW-16 through MW-22). Geophysical logging and pump tests were conducted as part of the RI. An early discovery following Phase I and II RI efforts was the identification of an aquitard (zone of less permeability) approximately 30 to 40 feet thick, the base of which is located between 690 and 790 feet above mean sea level. A total of seven shallow (perched) wells and nine deep wells were installed during the RI by SECOR.

One of the wells, MW-10, was installed as a sentry well to assess contaminant migration, if present, toward the City of Camdenton's Blair Municipal supply well. It was installed midway between the Modine facility and the Blair well on the next ridge top south of the facility.

Well Abandonment

Monitoring wells MW-3 and MW-4 were deepened at the request of the MDNR due to MW-4 being dry during two consecutive monitoring events in August and December 1996. Monitoring wells MW-3 and MW-4 were deepened to the depth of approximately 175 feet below top of casing and 195 feet below top of casing, respectively. When wells MW-3 and MW-4 were deepened in February 1997, they bridged the less permeable "inhibiting zone" and possibly allowed groundwater (when present) above this zone to migrate to the deeper zone. Both wells had originally been completed within the less permeable zone.

Based on this potential, Modine abandoned monitoring wells MW-3 and MW-4 in early October 2001 to eliminate any potential conduit from the shallow to the deep zone.

RI Results

Following the first two phases of the RI work, SECOR and Hamilton Sundstrand met with the MDNR to define data gaps and obtain consensus regarding several issues. The data gaps identified were:

- Extent of contamination in the deep aquifer, specifically downgradient of the former lagoon, needed better definition, and

- Hydraulic effects from the pumping of the Mulberry well also needed further definition.

Consensus with the MDNR was reached on the following issues:

- The extent of contamination in the perched zone is defined south of the Modine facility as the ravine where groundwater "daylights" (the low permeability zone is breached at the base of the valley south of the facility);

- Operation of the Mulberry well has a significant effect on regional hydrogeology and appears to be providing hydraulic containment of impacted groundwater in the deep zone;

- Natural Attenuation likely is not a viable remedial alternative for VOCs in groundwater; and

- Metals are not COCs in groundwater.

RI Conclusions

The following conclusions related to groundwater in the area of the Modine facility and the former lagoon were based on the results of all three phases of the RI:

- Two distinct groundwater zones were identified: a shallow, perched zone and a deep aquifer zone.

- VOCs in groundwater are characterized and limited to TCE and DCE.

- The majority of the contaminant mass has accumulated in the perched zone, due to the presence of a low permeability layer that inhibits downward migration, the base of which is at an elevation of approximately 693 to 789 feet above mean sea level.

- Elevated TCE spikes in the Mulberry well began to occur in late summer of 2001, immediately following and during the excavation of impacted soil along the west side of the Modine building.

  Note that this correlation is **incorrect** since on site excavation activities did not begin until October 2001.

- The extent of VOCs in both the deep and perched groundwater zones have been determined and is strongly influenced by preferential flow pathways including nearly vertical fractures and bedding plane separations.

- The extent of contamination in the shallow zone is defined to the east by MW-7 (west of MW-7) and to the west by MW-11 (east of MW-11), both wells exhibited non-detectable levels of VOCs. The extent to the south is defined by the ravine south of the Modine facility where the perched zone daylights (refer to consensus stated above). It is assumed that the VOC extent in the perched zone does not extend much further north than the former lagoon. This assumption is based on the fact that groundwater movement (infiltration of precipitation) within the upper, unsaturated portions of the bedrock would be nearly vertical through the fractures. Within the saturated portion of the bedrock, flow would be in the direction of groundwater movement as dictated by hydrostatic head along the preferential flow pathways. However, as demonstrated with former monitoring wells MW-3 and MW-4, there are times of the year when groundwater is non-existent in the perched zone (i.e., little to no saturation within the perched zone).

- The perched zone is **not** defined as an aquifer from a regulatory perspective since it does not store or produce water in recoverable quantities sufficient for private or public use. Therefore, exposure to groundwater within the perched zone is remote. Available

information indicates that residents are not using water derived from the perched zone. Residents in this area are provided water through the public water supply system.

[redacted]

Ex. 6 PII

- The pump tests indicated that the City's periodic pumping of the Mulberry well seems to be inhibiting the migration of TCE. Continuous pumping at the Mulberry well has the ability to provide effective hydraulic containment of VOCs in the deep aquifer.

- The City's removal of sediment from and closure of the former lagoon, along with Modine's removal of impacted soil at the west side of the manufacturing facility eliminated sources for further contaminant migration to groundwater.

A Feasibility Study was recommended to assess remedial alternatives and decide on a practical remedy to address groundwater impacts.

Feasibility Study

In October 2004, SECOR prepared a Feasibility Study (FS) on behalf of Hamilton Sundstrand that assessed remedial alternatives to mitigate the continued migration of contaminants in groundwater. A Groundwater Flow Model Report and Targeted Risk Assessment (TRA) were prepared in September 2004 in support of the FS. The following conclusions are based on the findings of the FS and support documents:

- Impacted soils in the area of the former lagoon and manufacturing facility are adequately addressed and do not pose a significant risk to human health and the environment.

- The results of the TRA indicate that impacted groundwater in the perched zone does not pose a significant risk to human health and should not affect goals to protect the City's potable water supply.

- The screening and analysis process identified six potentially viable remedial alternatives to address impacted groundwater in the deep zone. Of the six, containment was determined to be the most practical.

- Contaminant containment can be accomplished through continued pumping of the Mulberry well. Limited additional studies, such as a remedial design, will be required to determine the optimum pumping rates, appropriate monitoring locations, and potential equipment upgrades.

- Active remediation of the perched zone is not practical. Since continuing sources of contamination in soil have been eliminated, natural attenuation should address the perched zone impacts in time.

Quarterly Groundwater Sampling

SECOR has continued to conduct quarterly groundwater sampling of both the shallow and deep wells in the area of the former lagoon and facility. Sample results are reported for the VOCs in groundwater – TCE and cis-1,2-DCE. The most recent data available is for the year 2004. A summary of the relevant results from 2004 are discussed below:

- VOC concentrations in excess of the MCL and GTARC were present in shallow wells MW-5, MW-8, MW-9, MW-12 and MW-13. The highest TCE and cis-1,2-DCE concentrations were present in MW-8 located immediately south of the former lagoon.

- No VOCs have been detected in the sentry well MW-10.

- TCE concentrations in the two deep wells located on the Modine facility were below the MCL of 5 ug/L during every event, except for the January event in which the sample from MW-2 (east side) exhibited a concentration of 6.2 ug/L.

- The deep wells with VOC concentrations in excess of the MCL and GTARC were MW-14, MW-16, and MW-19.

Additional Data

Since the submittal of the FS, the City detected TCE in the City of Camdenton's Rodeo well as part of its ongoing municipal well sampling program. The Rodeo well is located near the airport over a mile east, southeast of the former lagoon and manufacturing facility.

TCE was detected at a concentration of 0.64 ppb, well below the MCL and GTARC of 5 ppb. Subsequent sampling by the MDNR showed no contaminant concentrations above detectable levels.

4. Conclusions and Summary

This document provides a comprehensive historical summary of all investigative and remedial activities that have taken place related to both the former Hulett lagoon and the Modine facility. The purpose in providing this information is to address the issues identified in the CME, in subsequent correspondence with MDNR and in further discussions with MDNR.

The unresolved issues focus on the following topics:

- potential source of VOCs in soil beneath the building floor of the Modine facility in the area of the former Monorail Vapor Degreaser, (SWMU 26)
- potential source of VOCs in soil along the former domestic wastewater line that conveyed wastewater from the facility to the former Hulett Lagoon
- adequate definition of the extent of trichloroethene (TCE) in groundwater in the shallow "perched " zone and "deep" zone south of the Modine facility
- adequate definition of the extent of TCE in groundwater in the "perched" zone north of former Hulett Lagoon
- the possibility of an evaluation of remedial alternatives for the shallow "perched" zone.

Facts from this comprehensive historical summary that support the conclusion that each of these issues have been, or will be, satisfactorily addressed are provided in the following paragraphs.

4.1 Conclusions

Potential source of VOCs in soil beneath the building floor of the Modine facility

The results from the soil sampling beneath the floor of the building in the area of the former monorail degreaser and reported drum storage area show that VOCs are present. However, additional investigation and/or remediation for these contaminants are not warranted based on the following:

- The area was never used as a drum storage area for waste solvents, but instead was used for storage of old equipment.
- The reported 4,500-gallon release of spent solvent in this area was actually a release of a neutralizing compound composed of water and soda ash used to clean out solvent tanks and vapor degreasers after the solvent had been removed.

- Other than TCE, no other identified VOCs (PCE, vinyl chloride, methylene chloride, 1,2-DCA, and 1,1,1-TCA) present in soil beneath the building have ever been detected in any groundwater analysis.

- During the 1997 renovation, Modine removed some of the soil and the gravel subgrade in this area and conducted sampling of the soil for TCLP VOCs for the purposes of disposal characterization. The results showed no TCLP VOC concentrations above detectable levels.

- Rhodamine dye injected into the gravel subgrade beneath the building foundation was not observed in any on-site or off-site monitoring wells. Therefore, no connection between the trapped water within the gravel subgrade and groundwater was demonstrated.

- Concentrations of the five VOCs identified in indoor air were all less than 1% of the lowest occupational exposure limit and below the calculated health-based screening levels for workers in an industrial setting. These results showed that there are no "unacceptable human exposures to contamination that can be reasonably expected under current land- and groundwater-use conditions". Therefore, the Camdenton facility achieved compliance with the Human Exposure Under Control EI.

- Subsequent calculations demonstrate that the concentrations of VOCs, specifically TCE, in soil both on the west side of the building as well as beneath the floor could account for the observed concentrations in indoor air. A chemical inventory assessment shows that it is highly unlikely that emissions from products used within the facility would have been the source for chlorinated VOCs, particularly TCE, detected in indoor air sampling.

- The presence of the building provides a cap that effectively precludes infiltration of precipitation as a vehicle for contaminant movement.

- The MDNR has concurred that no further action is necessary with regard to soil at the former Hulett Lagoon where similar TCE concentrations remain in soil.

With all the analytical data confirming that no substantial source of VOCs exists in soil beneath the floor of the building and the completion of the Human Exposure Under Control EI, no further action, investigative or remedial, is required for the soil source in this area.

Potential source of VOCs in soil along the former domestic wastewater line that formerly conveyed wastewater from the facility to the former Hulett Lagoon

There has been no direct sampling of soil surrounding off-site wastewater conveyance piping. However, a dye trace study completed in 1998 by MDNR showed that the City sewer line leaks and that the movement of any wastewater leaking from the line moves quickly to the "perched" zone. Since the line would be constantly flowing, this flushing action would drive any contamination through the overburden soil toward groundwater.

The flushing action would not allow any significant VOC contamination to remain in the soil surrounding the City line.

The confirmation soil sampling from removal of the onsite former wastewater discharge line demonstrates the effectiveness of continued flushing of the soil to remove significant VOC concentrations in surrounding soil. The line conveyed wastewater from the former mud pits on the west side of the facility to the City of Camdenton sewer main located at the north side of the Modine facility and was removed as part of a plant renovation. Confirmation soil sample results indicated that only very low concentrations of VOCs (well below the SSCG) remained in soil surrounding the line. The line was constructed of clay tile, had documented releases and still showed only very low VOC concentrations. The contaminant load (mass) in this section of line would be far greater than in the actual conveyance line to the lagoon.

It is our understanding that homes along Sunset also discharged to the conveyance line prior to discharge to the former lagoon. These additional discharges would result in dilution of the facility discharge with other sanitary waste streams prior to discharge to the lagoon. Based on these findings, the potential for a significant source of VOCs in soil surrounding the offsite wastewater conveyance line between the facility and the former Hulett Lagoon seems very unlikely.

With the soil analysis results from more concentrated areas upstream of domestic wastewater line being below SSCGs and the continual flushing action of the leaking line, no significant concentrations of VOCs would remain along the line. Therefore, no further investigation needs to be completed for this area.

Adequate definition of the extent of TCE in groundwater in the "deep" zone south of the Modine facility

The MDNR CME requested an additional deep monitoring well located south-southwest of Mulberry well to help in delineation of the deep plume. The MDNR believes that the sentry well MW-10 is too distant from the source area and screened too deep (200 feet deeper than other deep wells) to serve as an effective sentry well. As agreed to during the August 2005 meeting between MDNR and Modine, the Superfund Remedial Design (RD)/Remedial Action (RA) process will determine if an additional deep well or wells are necessary and the appropriate location of these wells.

It is anticipated that the RD will be completed within the next year. The MDNR will defer the decision on the installation of a deep monitoring well in this area until the RD/RA has been completed.

Adequate definition of the extent of TCE in groundwater in the "perched" zone north of former Hulett Lagoon and south of the Modine facility.

The MDNR requested the addition of a monitoring well **north** of the Hulett Lagoon near deep well MW-16 for delineation of the plume in the shallow zone. During the August, 2005 meeting it was agreed that the need for, and the location of, a shallow well in this area will be addressed through the RD/RA process.

The MDNR also requested the addition of a monitoring well south of the Modine Facility for additional delineation in the shallow zone. As agreed upon in the August 16, 2004 meeting, the need for a shallow well south of the facility is not necessary.

Evaluation of remedial alternatives for the shallow "perched" zone

MDNR wants an evaluation of potential remediation alternatives, particularly in-situ, for the shallow "perched" zone. In MDNR's opinion, an evaluation of potential remedial alternatives may indicate that a possible remedial action will be cost effective and could shorten the time for the selected RA (containment using the Mulberry Well) to return groundwater in the deep zone to a potable condition.

An FS (evaluation) for the shallow "perched" zone is not necessary based on the following:

- The results of the TRA indicate that impacted groundwater in the perched zone does not pose a significant risk to human health and should not affect goals to protect the City's potable water supply.

- Testing of the deep aquifer showed through pumping of the Mulberry well that there is some interconnection between the perched and deep zones. Therefore, continued pumping of the Mulberry well will also provide containment and remediation in the shallow zone.

- No in-situ technologies were retained in the FS for the deep zone due to technical or logistical factors. These same technical and logistical factors hold true for the shallow zone.

- The FS concluded that active remediation of the perched zone is not practical.

4.2 Summary

In summary, with the completion of multiple investigations, the establishment of the SSCG values, the completion of extensive remedial actions and the MDNR approvals of no further action in areas with similar residual concentrations, Modine feels that all areas of the Camdenton site have been adequately addressed and no further action, investigative or remedial, is required with regard to soil. Groundwater issues are also being addressed in a sufficient manner with final resolution of these issues to be determined in the near future.

5. References

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Figures

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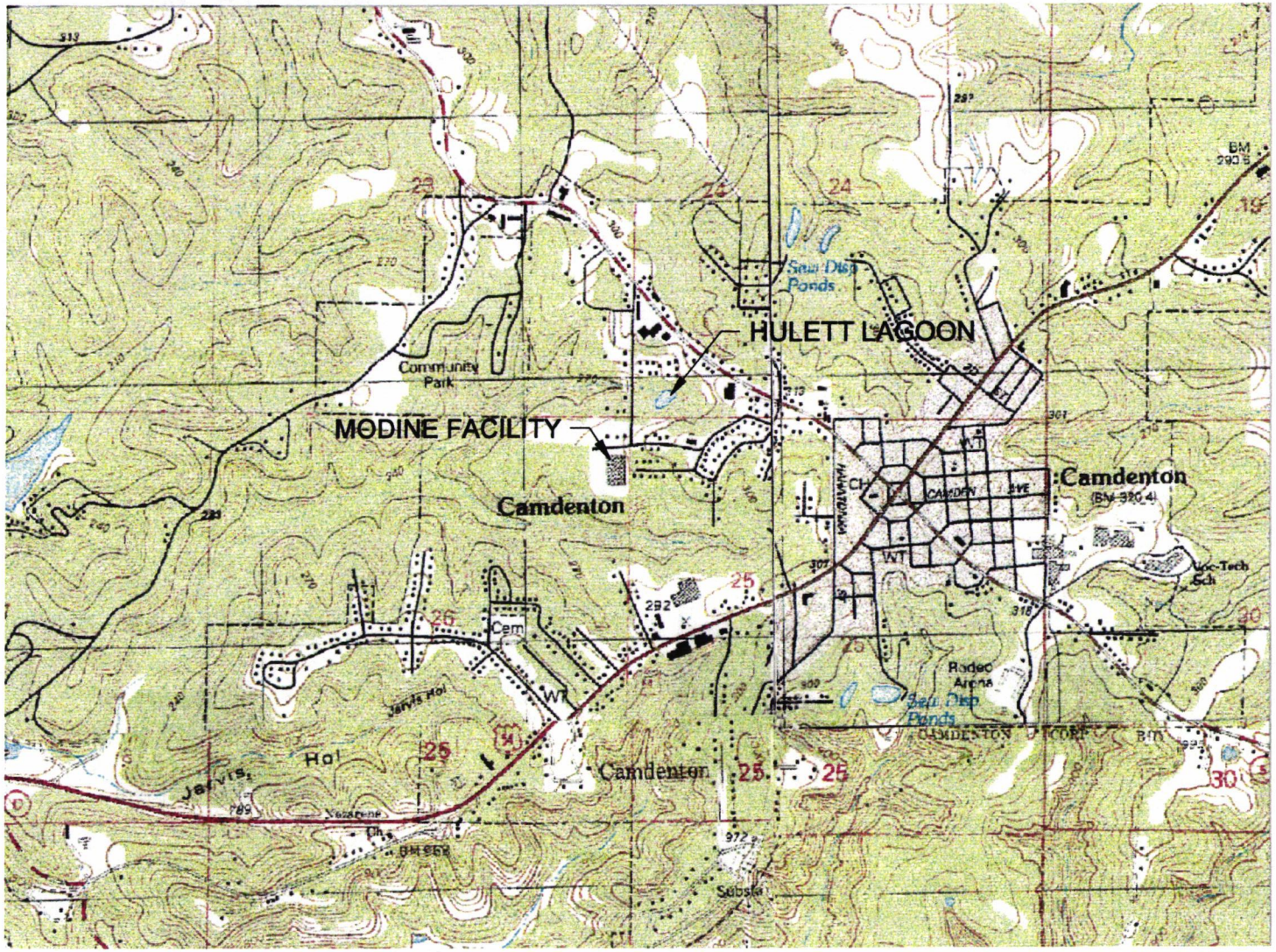

NOT TO SCALE

FIGURE 1
SITE LOCATION MAP
MODINE MANUFACTURING COMPANY
CAMDENTON, MISSOURI

CH2MHILL

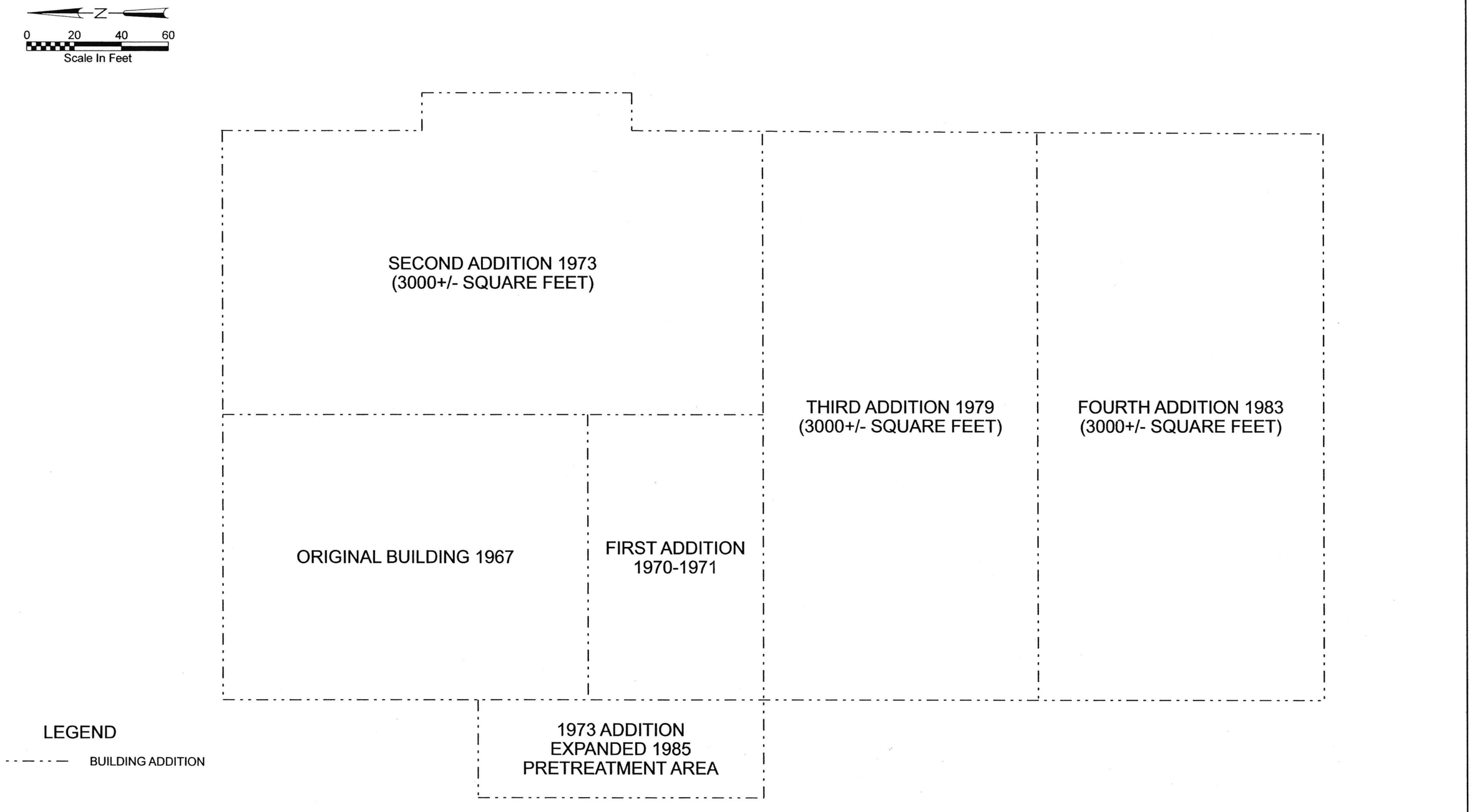

FIGURE 2
BUILDING EXPANSIONS
MODINE MANUFACTURING COMPANY
CAMDENTON, MISSOURI

CH2MHILL

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0 20 40 60
Scale In Feet

SWMU 26
VAPOR DEGREASER
AND STILL M587

SWMU 31
DRUM STORAGE
AREA 3

SOLVENT
STORAGE TANKS

SWMU 2
MUDPITS

SWMU 2
MUDPITS

SWMU 5
DRUM STORAGE
AREA 2

SWMU 4
DRUM STORAGE
AREA 1

LEGEND

SWMU

FIGURE 3
SWMUs RECOMMEDED FOR FURTHER INVESTIGATION
MODINE MANUFACTURING COMPANY
CAMDENTON, MISSOURI

CH2MHILL

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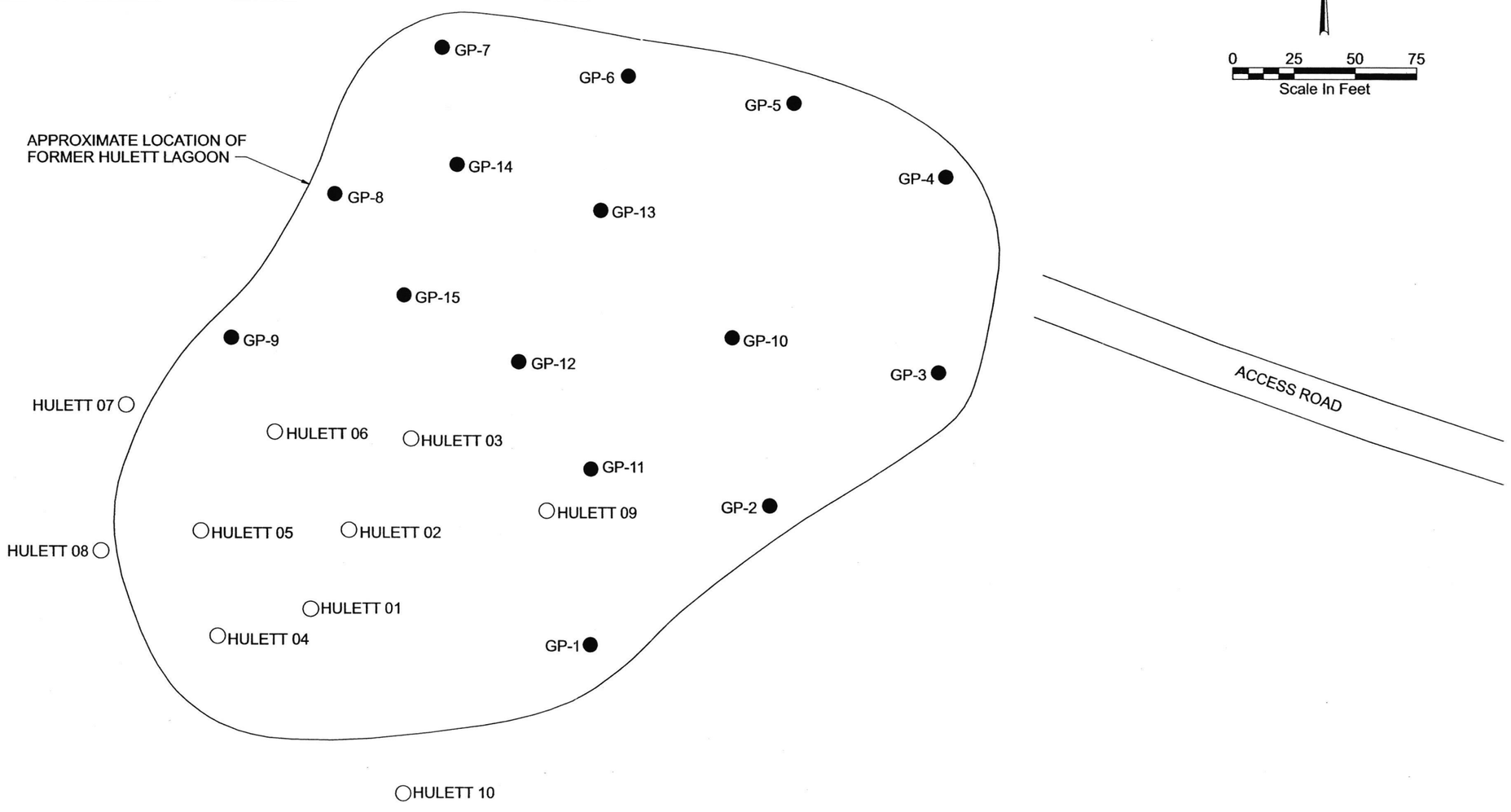

LEGEND

GP-3● SECOR SOIL BORING LOCAITON, JUNE 2000

HULETT 08○ MDNR SOIL BORING LOCAITON, JANUARY 1999

FIGURE 4
HULETT LAGOON SOIL SAMPLE LOCATIONS
MODINE MANUFACTURING COMPANY
CAMDENTON, MISSOURI

CH2MHILL

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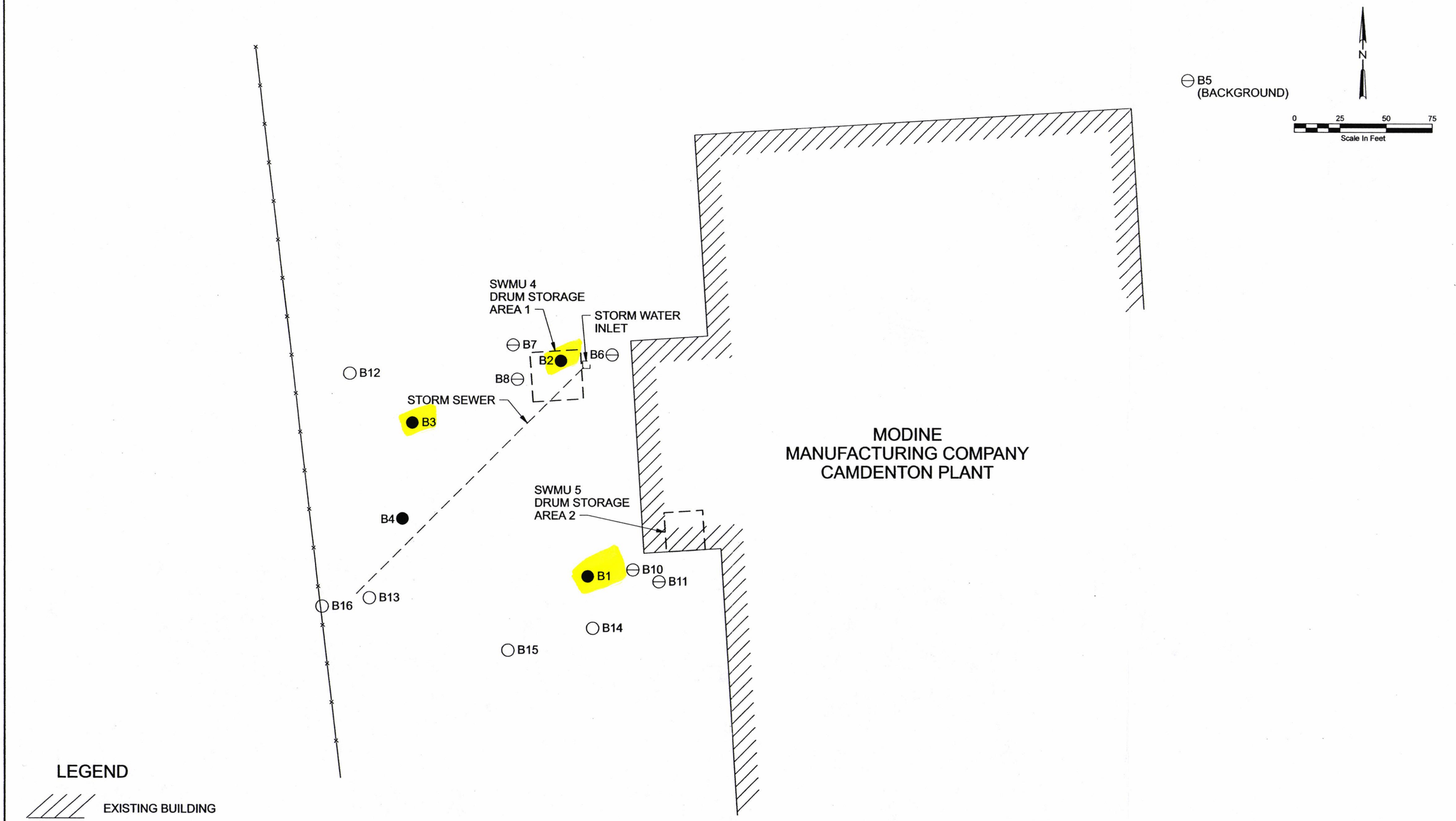

LEGEND

- EXISTING BUILDING
- EXISTING FENCE
- B15 — DAMES AND MOORE BORINGS, 1995
- B8 — LAW BORINGS, 1993
- B1 — LAW BORINGS, 1991

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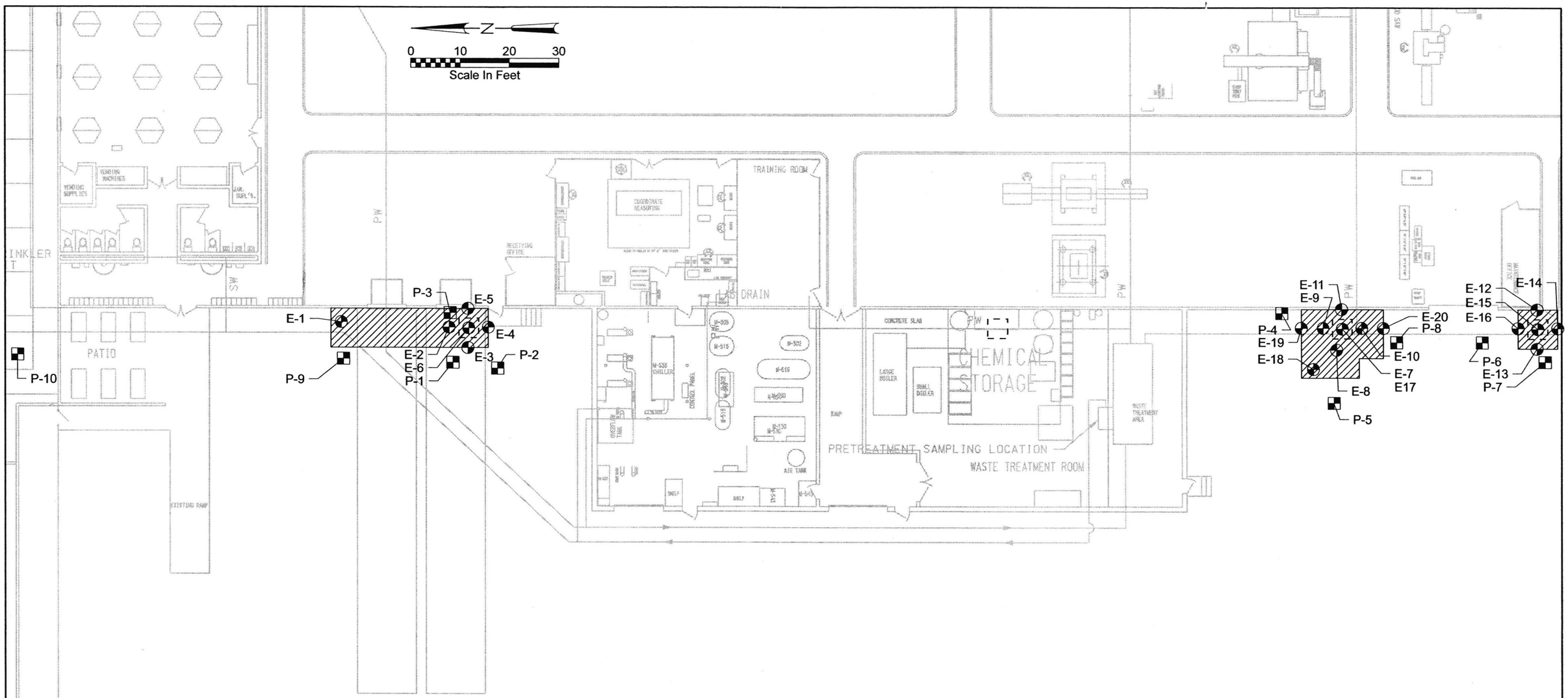
FIGURE 5
DRUM STORAGE AREAS 1 AND 2
SOIL BORING LOCATIONS

MODINE MANUFACTURING COMPANY
CAMDENTON, MISSOURI

CH2MHILL



LEGEND

- – – – – – MUDPIT
- EXCAVATION AREA
- P-9 PROBE LOCATION
- E-1 EXCAVATION SOIL SAMPLE

FIGURE 6
MUDPIT PROBE LOCATIONS AND EXCAVATION LIMITS
MODINE MANUFACTURING COMPANY
CAMDENTON, MISSOURI

CH2MHILL

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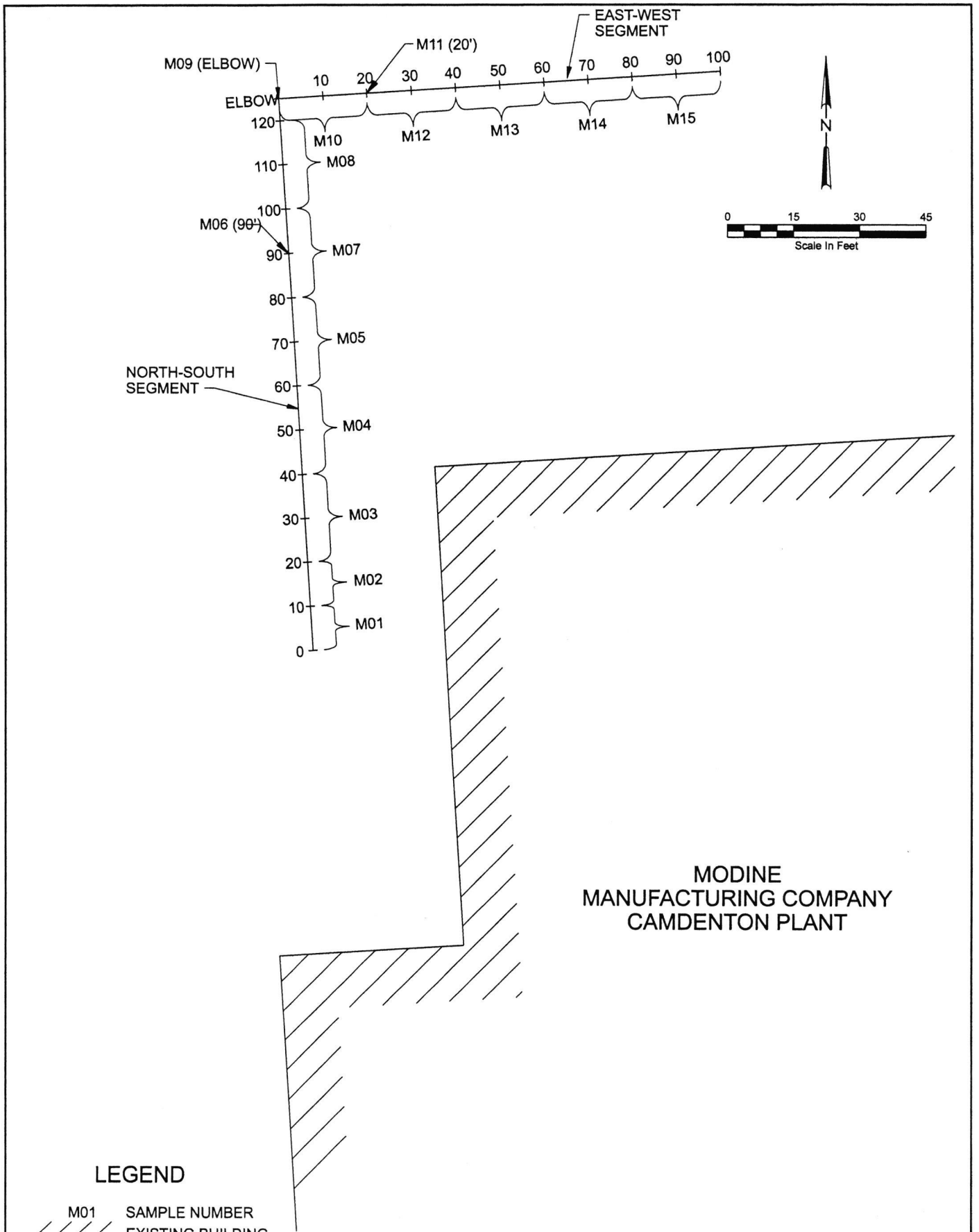

FIGURE 7
FORMER WASTEWATER DISCHARGE LINE EXCAVATION AND CONFIRMATION SAMPLE LOCATIONS
MODINE MANUFACTURING COMPANY
CAMDENTON, MISSOURI

CH2MHILL

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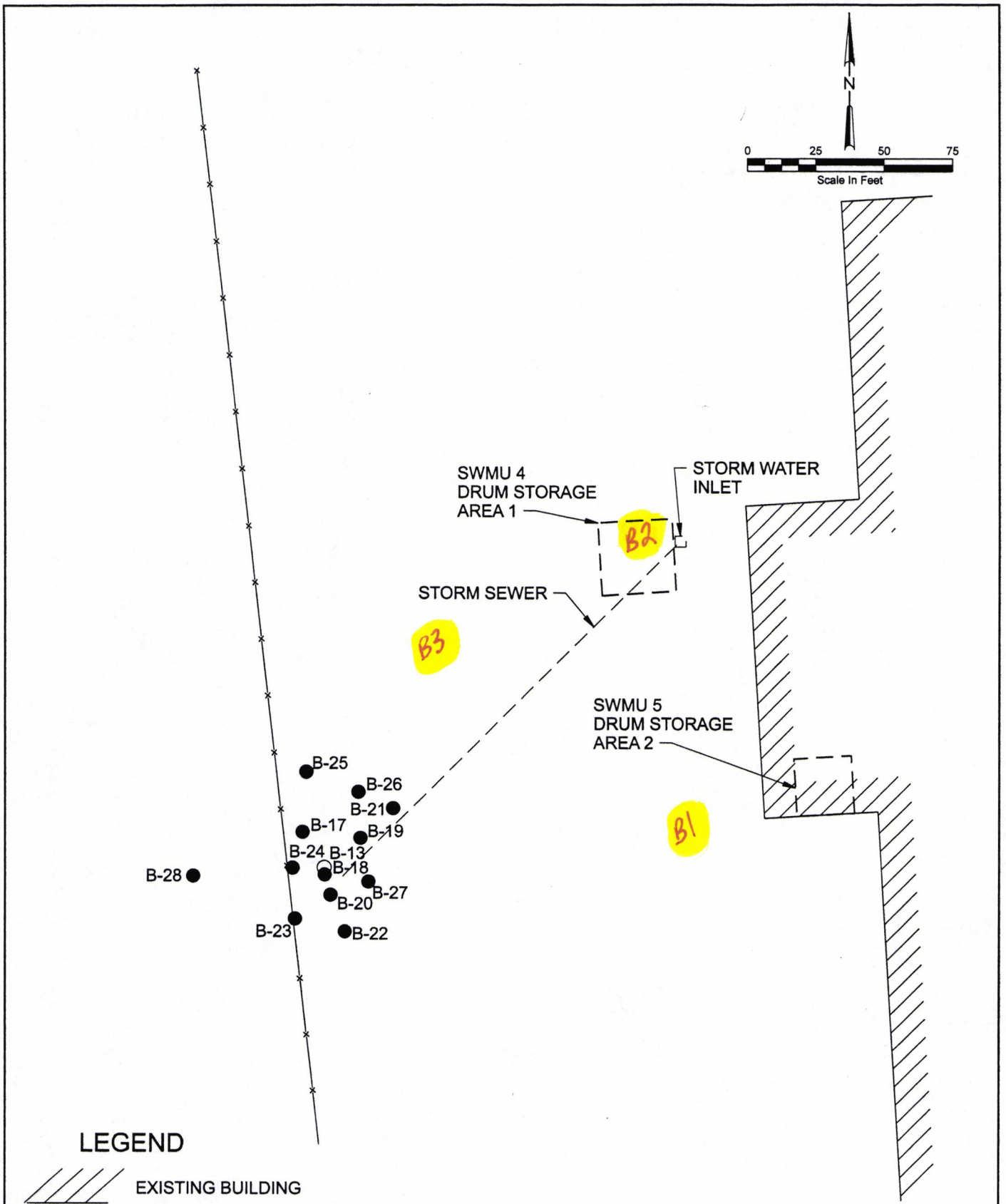

FIGURE 8
WEST SIDE OF BULDING
SOIL BORING LOCATIONS
MODINE MANUFACTURING COMPANY
CAMDENTON, MISSOURI

CH2MHILL

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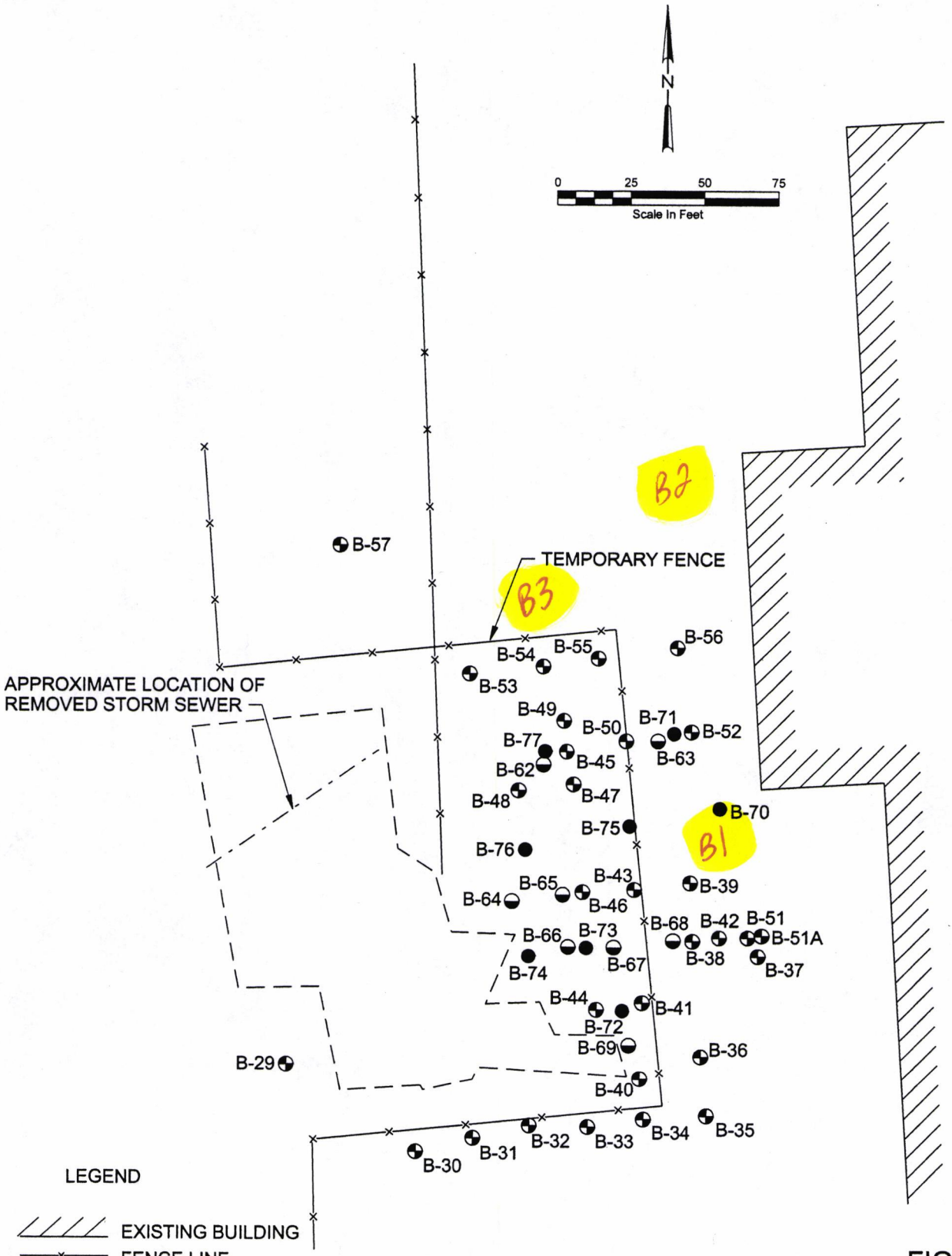

FIGURE 9
WEST SIDE OF BUILDING
ORIGINAL EXCAVATION LIMITS (2001)
AND DELINEATION PROBE LOCATIONS
MODINE MANUFACTURING COMPANY
CAMDENTON, MISSOURI

CH2MHILL

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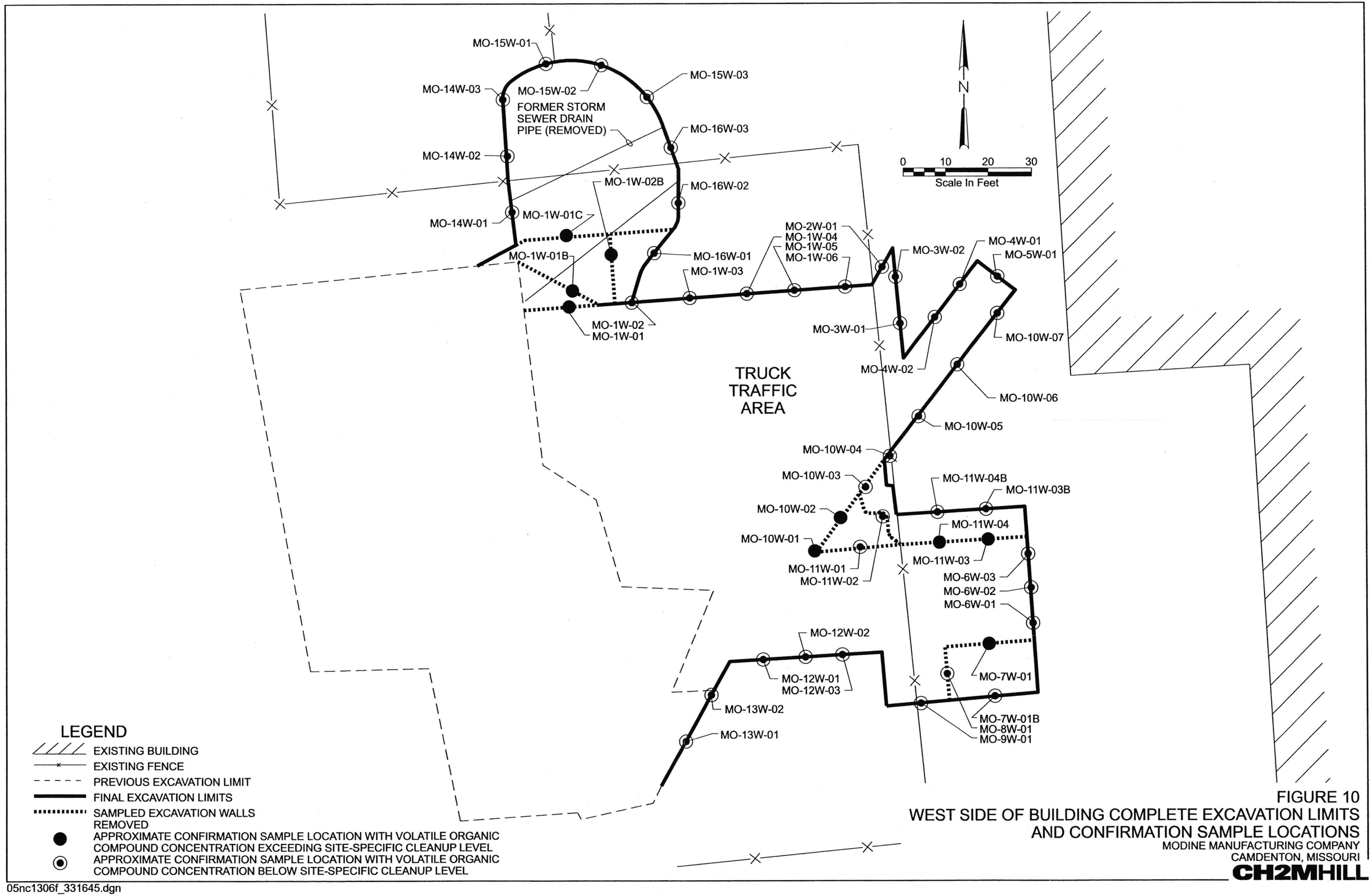

FIGURE 10
WEST SIDE OF BUILDING COMPLETE EXCAVATION LIMITS AND CONFIRMATION SAMPLE LOCATIONS
MODINE MANUFACTURING COMPANY
CAMDENTON, MISSOURI

CH2MHILL

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0 20 40 60
Scale In Feet

P-4
HA-3
P-6
SWMU26
VAPOR DEGREASER
AND STILL M587
HA-5 (PIT TRAP)
P-3
HA-2
P-9
P-7
P-8
HA-1
HA-4
P-2
SOLVENT
STORAGE TANKS
P-5
P-10
P-1

LEGEND

HA-1 LAW HAND AUGER BORING, 1991

P-5 DAMES AND MOORE PROBE, 1997

VAPOR DEGREASER PIT

FIGURE 11
FORMER MONORAIL VAPOR DEGREASER AREA
BORING AND PROBE LOCATIONS
MODINE MANUFACTURING COMPANY
CAMDENTON, MISSOURI
CH2MHILL

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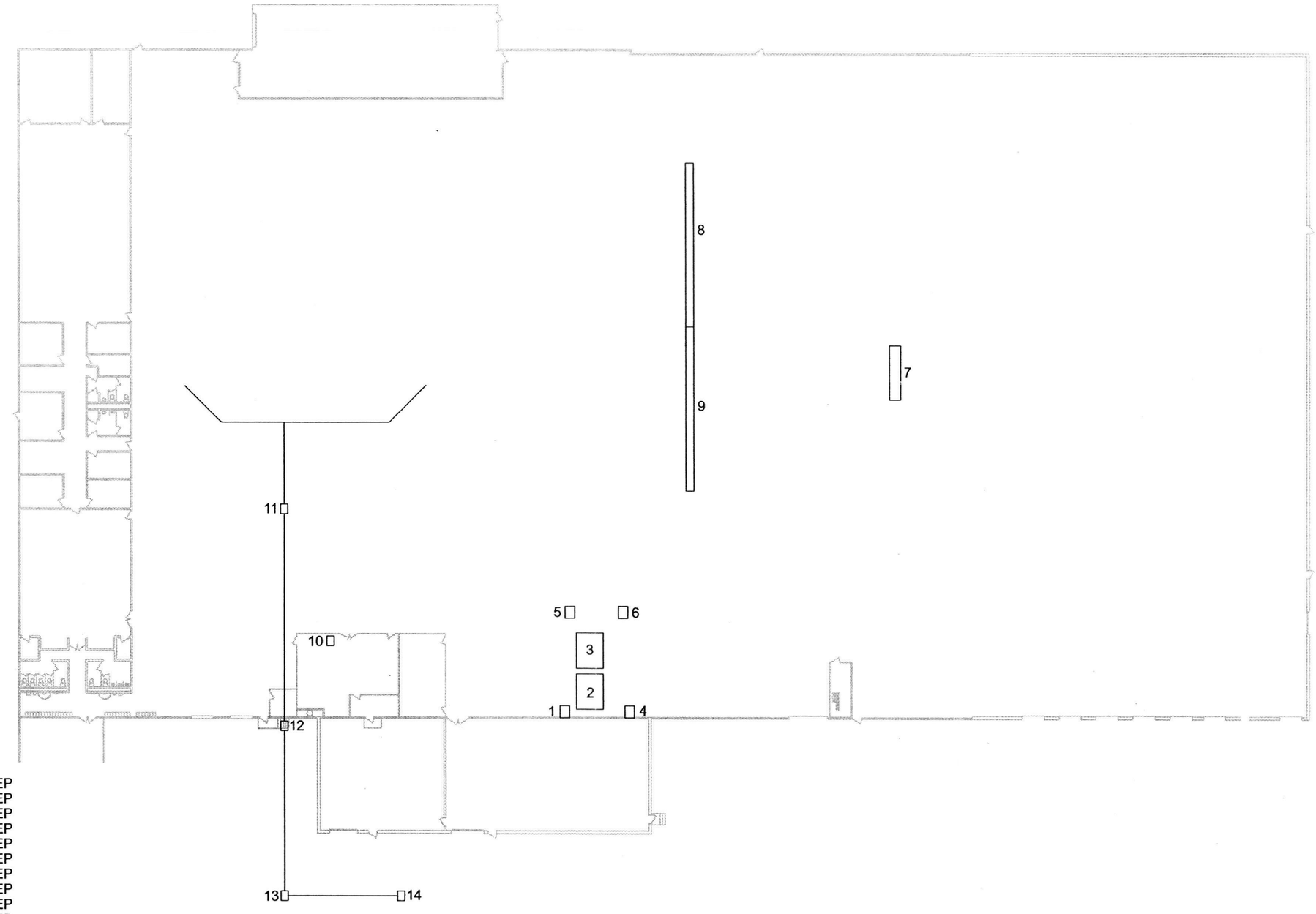
N

0 20 40 60

Scale In Feet



LEGEND

SAMPE LOCATIONS AND DEPTH

1	CUPOLA FOOTING	4' DEEP
2	PRESS FOUNDATION	5' DEEP
3	PRESS FOUNDATION	5' DEEP
4	CUPOLA FOOTING	4' DEEP
5	CUPOLA FOOTING	2' DEEP
6	CUPOLA FOOTING	3' DEEP
7	RESTROOM PLUMBING	1' DEEP
8	TRENCH DRAIN	3' DEEP
9	TRENCH DRAIN	3' DEEP
10	JIB CRANE FOUNDATION	4' DEEP
11	STROM DRAIN	3' DEEP
12	STORM DRAIN	2' DEEP
13	STORM DRAIN	3' DEEP
14	STORM DRAIN	4' DEEP

FIGURE 12
BUILDING RENOVATION SAMPLE LOCATIONS
MODINE MANUFACTURING COMPANY
CAMDENTON, MISSOURI

CH2MHILL

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0 20 40 60
Scale In Feet

MD-AS-01
MD-AS-02
MD-AS-03
MD-AS-04
MD-AS-05
MD-AS-06
MD-AS-07
MD-AS-08

SWMU 26
VAPOR DEGREASER
AND STILL M587

SWMU 31
DRUM STORAGE
AREA 3

SOLVENT
STORAGE TANKS

SWMU 2
MUDPITS

SWMU 2
MUDPITS

SWMU
DRUM STORAGE
AREA 2

SWMU 4
DRUM STORAGE
AREA 1

LEGEND

SWMU

MD-AS-02 INDOOR AIR SAMPLE LOCAITON

FIGURE 13
INDOOR AIR SAMPLING LOCATIONS
MODINE MANUFACTURING COMPANY
CAMDENTON, MISSOURI

CH2MHILL

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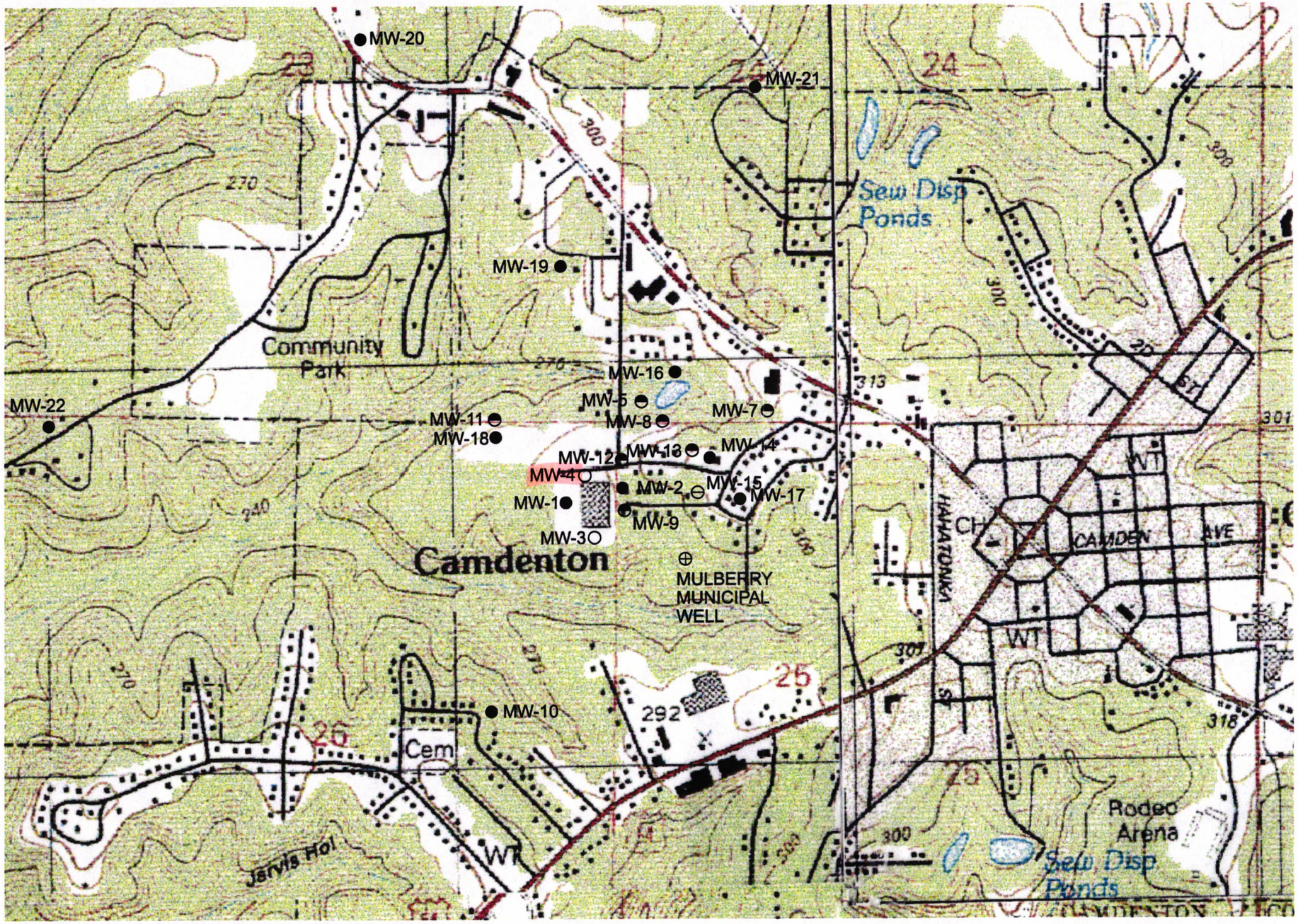

LEGEND

- MW-12◓ SHALLOW WELL
- MW-15⊖ SHALLOW WELL (ABANDONED)
- MW-18● DEEP WELL
- MW-3○ DEEP WELL (ABANDONED)
- ⊕ MUNICIPAL WELL

FIGURE 14
MONITORING WELL LOCATIONS
MODINE MANUFACTURING COMPANY
CAMDENTON, MISSOURI

CH2MHILL

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Tables

TABLE 1

Hulett Lagoon Investigation (SECOR 2000) - Soil Sample Analytical Results

ANALYTE	UNITS	SOIL SAMPLES - MOBILE LABORATORY														
		GP-1 9.5'-10'	GP-2 8.5'-9'	GP-3 6'-7'	GP-4 8'-9'	GP-5 7'-8'	GP-6 4'-5'	GP-7 6'-7'	GP-8 3'-4'	GP-9 7'-8'	GP-10 6.5'-7.5'	GP-11 8'-9'	GP-12 5'-6'	GP-13 6'-7'	GP-14 10'-11'	GP-15 5.5'-6.5'
Trichloroethene	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	248.47	ND	ND	ND	ND	ND	ND

ug/Kg - micrograms/Kilogram (ppb)
Analysis by EPA Method 3810 "Static Heated Headspace"
ND - Analyte not detected within reporting limits of the test
10 -11'- Approximate sample depths in feet below ground surface

ANALYTE	UNITS	SOIL SAMPLES - FIXED LABORATORY														
		GP-1 9.5'-10'	GP-2 8.5'-9'	GP-3 6'-7'	GP-4 8'-9'	GP-5 7'-8'	GP-6 4'-5'	GP-7 6'-7'	GP-8 3'-4'	GP-9 7'-8'	GP-10 6.5'-7.5'	GP-11 8'-9'	GP-12 5'-6'	GP-13 6'-7'	GP-14 10'-11'	GP-15 5.5'-6.5'
Trichloroethene	ug/Kg	ND	ND	ND	ND (1)	ND (1)	ND (1) (2)	ND	ND (1)	3,100 (1) (3)	ND (1) (2)	ND (1)	ND (1)	ND (1) (2)	ND (1) (2)	ND (1) (2)
CIS 1,2-Dichloroethene (Total)	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	650 (3)	ND	ND	ND	ND	ND	ND
Mercury	ug/Kg	0.3	0.15	0.068	0.035	0.071	0.061	0.061	0.2	0.11	ND	0.097	ND	ND	0.089	ND
Arsenic	ug/Kg	9.6	2	9.2	3.5	9	1.8	5.8	7.5	10.3	2.6	9.3	11	3.7	6.6	6
Lead	ug/Kg	36.5	6.8	79.5	49.6	98.8	24.4	21.5	19.3	91.4	36.6	47.2	43	25.6	73.3	30.3
Barium	ug/Kg	93.7	27.9	113	26.3	81	168	39.5	119	258	3.4	67.2	172	51.8	59.9	27.9
Cadmium	ug/Kg	ND	0.66	2.4	0.48	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	ug/Kg	30.4	2	9.2	4.3	11.8	8.8	16.6	23.2	34.4	3.6	18.8	20.4	7.8	12.8	22.4

(1) Methylene Chloride detected above reporting limits - suspected laboratory artifact
(2) Acetone detected above reporting limits - suspected laboratory artifact
(3) Laboratory calibration range exceeded
Analysis by USEPA Method 8260B(VOCs) and Method 7470A/7471A/6010B (Metals)
ND - Analyte not detected within reporting limits of the test
10' - 11' - Approximate sample depths in feet below ground surface

TABLE 2

West Side of Building Investigation (Law 1991) - Soil Sample Analytical Results

Sample I.D.		B-1	B-2	B-3	B-4
Sample Depth (Feet)		2.0-4.0	2.0-4.3	2.0-4.0	4.0-8.0
Collection Date		10/8/1991	10/8/1991	10/8/1991	10/8/1991
ANALYTE	UNITS				
Chloromethane	mg/kg	ND	ND	ND	ND
Vinyl Chloride	mg/kg	ND	ND	ND	0.078
Chloroethane	mg/kg	ND	ND	ND	ND
Trichlorofluoromethane	mg/kg	ND	ND	ND	ND
1,1 - Dichloroethene	mg/kg	ND	ND	ND	ND
Methylene Chloride	mg/kg	0.0084	0.0048	ND	ND
trans - 1,2,Dichloroethene	mg/kg	ND	ND	ND	0.012
1,1-Dichloroethane	mg/kg	0.0062	ND	ND	ND
Chloroform	mg/kg	ND	ND	ND	ND
1,1,1-Trichloroethane	mg/kg	0.16	0.0012	0.0059	ND
Carbon Tetrachloride	mg/kg	ND	ND	ND	ND
1,2-Dichloroethane	mg/kg	0.061	ND	ND	ND
Trichloroethylene	mg/kg	ND	ND	ND	ND
1,2-Dichloropropane	mg/kg	ND	ND	ND	ND
Bromodichloromethane	mg/kg	ND	ND	ND	ND
2-chloroethylvinyl ether	mg/kg	ND	ND	ND	ND
trans-1,3-Dichloropropane	mg/kg	ND	ND	ND	ND
1,1,2-Trichloroethane	mg/kg	ND	ND	ND	ND
Tetrachloroethene	mg/kg	0.0058	ND	ND	ND
Dibromochloromethane	mg/kg	ND	ND	ND	ND
Chlorobenzene	mg/kg	ND	ND	ND	ND
Bromoform	mg/kg	ND	ND	ND	ND
1,1,2,2-Tetranchloroethane	mg/kg	ND	ND	ND	ND
1,3-Dichlorobenzene	mg/kg	ND	ND	ND	ND
1,4-Dichlorobenzene	mg/kg	ND	ND	ND	ND
1,2-Dichlorobenzene	mg/kg	ND	ND	ND	ND

ND - Not Detected at method detection limit

TABLE 3

Closure Investigation (Dames and Moore 1995) - Soil Sample Analytical Results

Sample Identification		VOC Constituent			
Soil Boring	Depth (feet)	TCE	PCE	1,1-Dichloroethene	Methlyene Chloride
B-13	8.5-13	204	2.18	ND	ND
B-16	6"-4.5	0.0289	ND	0.0109	0.029 B
B-17	4.5	0.0035	ND	ND	0.013 B

Notes:

Results in milligrams/kilogram (mg/kg)

B - Analyte identified in blank

ND - Not Detected

Samples submitted to laboratory from three of the six borings advanced

TABLE 4

Mudpit Investigation and Removal (Dames and Moore 1997) - Soil Sample VOC Analytical Results

Investigation Results

Soil Boring	Depth	TCE	Cis-1,2-DCE	Naphthalene	1,2,3-Trichlrobenzene	Xylene	2-Butanone
P-1	8-10	0.059	0.077	0.004	0.003	ND	ND
P-2	0-4	0.07	0.004	ND	ND	ND	ND
P-3	4-7	0.003	ND	ND	ND	ND	ND
P-4	8-10	0.19	0.069	ND	ND	ND	ND
P-5	NS	NS	NS	NS	NS	NS	NS
P-6	4-8	**0.9**	0.015	ND	ND	0.002	ND
P-7	0-4	0.018	0.014	ND	ND	ND	0.012
P-8	0-4	0.032	0.021	ND	ND	ND	ND
P-9	4-6	0.123	0.108	ND	ND	ND	ND
P-10	NS	NS	NS	NS	NS	NS	NS

Excavation Confirmation Sample Results

Confirmation Sample	1,2-DCE	TCE	PCE	1,2,4-Trimethylbenzene	1,2,5-Trimethylbenzen
E-1	0.21	0.064	ND	ND	ND
E-2	0.169	**0.74**	ND	ND	ND
E-3	0.01	0.276	ND	ND	ND
E-4	0.001	0.275	ND	ND	ND
E-5	ND	0.011	ND	ND	ND
E-6	0.235	**0.925**	ND	ND	ND
E-7	0.075	0.375	ND	0.021	0.012
E-8	0.064	0.016	ND	ND	ND
E-9	0.545	**0.385**	ND	ND	ND
E-10	0.03	0.158	ND	ND	ND
E-11	0.19	0.175	ND	ND	ND
E-12	0.43	**1.975**	ND	ND	ND
E-13	ND	ND	ND	ND	ND
E-14	0.122	0.256	0.451	0.451	0.451
E-15	0.069	**0.383**	ND	ND	ND
E-16	0.207	**0.392**	ND	ND	ND
E-17	Only analyzed for metals				
E-18	Only analyzed for metals				
E-19	Only analyzed for metals				
E-20	Only analyzed for metals				

Notes

Units in milligrams/kilogram (mg/kg)

ND - Not Detected

NS - Not Sampled

Bold - Above SSCG

TABLE 5

Onsite Wastewater Discharge Line Removal (CH2M HILL 1999) - Soil Sample Analytical Results

Analyte	Units	CALM Scenario A Screening Levels	CALM C_{leach} Screening Levels	Sample ID>>	M01B	M01W	M02B	M02W	M03B	M03W	M04B	M04W	M05B	M05W
				Trench Segment>>	N-S	N-S	N-S	N-S	N-S	N-S	N-S	N-S	N-S	N-S
				Sample Interval>>	0-10	0-10	10-20	10-20	20-40	20-40	40-60	40-60	60-80	60-80
VOCs														
Acetone	mg/kg	2,700	NA		ND	**0.031**	ND	**0.032**	ND	ND	ND	**0.024**	ND	ND
Carbon Disulfide	mg/kg	630	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethene (total)	mg/kg	1200*	0.5*		**0.021**	**0.16**	**0.016**	**0.022**	ND	ND	**0.0083**	ND	ND	ND
Methylene Chloride	mg/kg	51	0.02		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	mg/kg	40	0.1		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	mg/kg	650	3.7		ND	**0.0091**	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	mg/kg	40	0.1		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Metals														
Cadmium	mg/kg	110	11		ND	ND	**0.38**	ND	ND	ND	ND	ND	ND	ND
Chromium	mg/kg	2,100	38		**49.9**	**34**	**37.2**	**37.8**	**20.4**	**48.3**	**16.1**	**12.9**	**13.6**	**28.3**
Lead	mg/kg	260	NA		**679**	**327**	**303**	**825**	**34.3**	**69**	**40.9**	**69.8**	**25.9**	**58**
Silver	mg/kg	140	26		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Notes:

*CALM value presented is for cis-1,2-Dichloroethene

N-S = North-South Trench Segment

E-W = East-West Trench Segment

CALM = Cleanup Levels for Missouri

NA = Not Available

ND = Not Detected

B = Analyte identified in blank

Detected values are shown in bold.

Detected values greater than the screening levels are shaded.

TABLE 5

Onsite Wastewater Discharge Line Removal (CH2M HILL 1999) - Soil Sample Analytical Results

Analyte	Units	CALM Scenario A Screening Levels	CALM C_{leach} Screening Levels	Sample ID>>	M06S	M07B	M07W	M08B	M08W	M09E	M10B	M10W	M11S	M12B
				Trench Segment>>	N-S	N-S	N-S	N-S	N-S	N-S	E-W	E-W	E-W	E-W
				Sample Interval>>	90	80-100	80-100	100-120	100-120	elbow	0-20	0-20	20	20-40
VOCs														
Acetone	mg/kg	2,700	NA		ND	ND	**0.024**	ND	ND	**0.026**	ND	ND	**0.022**	ND
Carbon Disulfide	mg/kg	630	NA		ND	ND	ND	ND	ND	**0.0067**	ND	ND	ND	ND
1,2-Dichloroethene (total)	mg/kg	1200*	0.5*		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	mg/kg	51	0.02		**0.029**	ND	ND	ND	ND	ND	ND	ND	**0.090B**	ND
Tetrachloroethene	mg/kg	40	0.1		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	mg/kg	650	3.7		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	mg/kg	40	0.1		ND	ND	ND	ND	ND	ND	ND	ND	**0.021**	ND
Metals														
Cadmium	mg/kg	110	11		**0.79**	ND	ND	ND	ND	ND	ND	ND	**4.7**	ND
Chromium	mg/kg	2,100	38		**431**	**18.5**	**22.8**	**22.1**	**18.3**	**28.2**	**30.9**	**19.6**	**4,890**	**14.5**
Lead	mg/kg	260	NA		**29.3**	**95.6**	**25.5**	**30**	**24.6**	**28**	**70**	**36.2**	**101**	**28.8**
Silver	mg/kg	140	26		ND	ND	ND	ND	ND	ND	ND	ND	**2**	ND

Notes:

*CALM value presented is for cis-1,2-Dichloroethene

N-S = North-South Trench Segment

E-W = East-West Trench Segment

CALM = Cleanup Levels for Missouri

NA = Not Available

ND = Not Detected

B = Analyte identified in blank

Detected values are shown in bold.

Detected values greater than the screening levels are shaded.

TABLE 5

Onsite Wastewater Discharge Line Removal (CH2M HILL 1999) - Soil Sample Analytical Results

Analyte	Units	CALM Scenario A Screening Levels	CALM C_{leach} Screening Levels	Sample ID>>	M12W	M13B	M13W	M14B	M14W	M15B	M15W	M16S
				Trench Segment>>	E-W	E-W	E-W	E-W	E-W	E-W	E-W	Soil Stockpile
				Sample Interval>>	20-40	40-60	40-60	60-80	60-80	80-100	80-100	--
VOCs												
Acetone	mg/kg	2,700	NA		ND	ND	ND	**0.034**	**0.061**	**0.032**	**0.035**	**0.035B**
Carbon Disulfide	mg/kg	630	NA		ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethene (total)	mg/kg	1200*	0.5*		ND	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	mg/kg	51	0.02		ND	ND	ND	ND	ND	ND	ND	**0.014**
Tetrachloroethene	mg/kg	40	0.1		ND	ND	ND	ND	**0.033**	ND	ND	ND
Toluene	mg/kg	650	3.7		ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	mg/kg	40	0.1		ND	ND	ND	ND	ND	ND	ND	ND
Metals												
Cadmium	mg/kg	110	11		ND	ND	ND	ND	**1**	ND	ND	ND
Chromium	mg/kg	2,100	38		**59.5**	**15**	**33.6**	**28.7**	**34.4**	**27.9**	**24**	**16.4**
Lead	mg/kg	260	NA		**38.4**	**17.5**	**37.3**	**226**	**197**	**133**	**1,010**	**47.5**
Silver	mg/kg	140	26		ND	ND	ND	ND	ND	ND	ND	ND

Notes:

*CALM value presented is for cis-1,2-Dichloroethene

N-S = North-South Trench Segment

E-W = East-West Trench Segment

CALM = Cleanup Levels for Missouri

NA = Not Available

ND = Not Detected

B = Analyte identified in blank

Detected values are shown in bold.

Detected values greater than the screening levels are shaded.

TABLE 6

Investigation West Side of Building (CH2M HILL 2000) - Soil Sample Analytical Results

Constituents	BH-1A (11) B-17	BH-2A (11) B-19	BH-3A (10) B-20	BH-4A (6) B-18	B-21 (11)	B-22 (9)	B-23A (9.5)	B-23B (9.5)	B-24 (11)	B-25 (9.5)	B-26 (13.5)	B-27 (10.5)	B-28 (1)	CALM C_{LEACH} Levels
VOCs														
Xylenes	0.01	ND	0.006	0.006	ND	0.008	ND	ND	ND	ND	0.015	0.015	ND	55
Vinyl Chloride	1.8 E	1.1 E	1.1 E	0.9 E	0.32 E	1.2	0.28 E	0.26	0.98 E	0.32	12 E	1.6	ND	0.016
1,1-Dichloroethene	0.2	0.013	ND	ND	ND	ND	ND	ND	0.023	ND	ND	ND	ND	0.1
Acetone	0.15	0.024	0.052	0.27	ND	0.085	0.019	0.027	0.028	ND	0.015	0.064	ND	14
Methylene Chloride	0.023 B	0.015 B	0.016 B	0.03 B	0.017 B	0.012 B	0.013 B	0.014 B	0.014 B	0.017 B	0.015 B	0.013 B	0.012 B	0.021
trans-1,2-Dichloroethene	0.085	0.026	0.006	0.018	ND	ND	ND	ND	0.068	ND	0.017	ND	ND	1.13
cis-1,2-Dichloroethene	30	7.8	3.2 E	20	0.31 E	4.8	0.054	0.46 E	7.7 E	2.2 E	0.160	6.4	ND	0.51
Trichloroethene	220	0.083	0.006	20	0.024	ND	ND	ND	ND	ND	ND	ND	ND	0.097
Toluene	0.027	0.005	0.01	0.013	ND	0.013	ND	ND	ND	ND	0.018	0.016	ND	5.13
1,1,2-Trichloroethane	0.056	ND	ND	0.099	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.049
Tetrachloroethene	1.2	ND	ND	0.093	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.42
p-Isopropyltoluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.005	ND	NA
4-Methyl-2-pentanone	ND	ND	ND	0.027	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA

Notes:
Units in milligrams/kilogram (mg/kg)
ND = Not Detected
NA = Not Available
Screening Levels = MDNR CALM, September 1998 (revised 2001), Soil Target Concentration (STARC) Leaching to Groundwater Pathway (C_{LEACH})
Shaded cells indicate a concentration in excess of CALM STARC (C_{LEACH})
B-21 (11) = Sampled depth in feet below ground surface noted in parentheses
B-23A & B-23B are duplicate samples
E = Estimated value
B = Analyte identified in blank

TABLE 7

Delineation Investigation West Side of Building (CH2M HILL 2001) - Soil Sample Analytical Results

	SAMPLE IDENTIFICATION									
Volatile Organic Compound[1]	**MO-SB29 (6.0-8.0)**	**MO-SB30 (8.0-10.0)**	**MO-SB32 (5.0-7.0)**	**MO-SB34 (3.5-5.5)**	**MO-SB34 (3.5-5.5DUP)**	**MO-SB36 (2.5-4.5)**	**MO-SB37 (0.0-1.5)**	**MO-SB39 (2.0-4.0)**	**MO-SB40 (3.5-5.5)**	**CALM STARC C_{LEACH} LEVELS**
cis-1,2-Dichloroethene (mg/kg)	ND(0.0061)	ND(0.0054)	**0.157**	**0.863**	**0.916**	**0.120**	**1.01**	**0.013**	**1.01**	**0.500**
trans-1,2-Dichloroethene (mg/kg)	ND(0.0061)	ND(0.0054)	ND(0.006)	ND(0.0059)	**0.0072**	ND(0.006)	**0.0075**	ND(0.006)	ND(0.0057)	**0.100**
Ethylbenzene (mg/kg)	ND(0.0061)	ND(0.0054)	ND(0.006)	**0.019**	ND(0.0065)	ND(0.006)	ND(0.0065)	**0.024**	ND(0.0057)	**32.0**
Trichloroethene (mg/kg)	ND(0.0061)	ND(0.0054)	ND(0.006)	ND(0.0059)	ND(0.0065)	ND(0.006)	ND(0.0065)	**0.025**	ND(0.0057)	**0.100**
1,2,4-Trimethylbenzene (mg/kg)	ND(0.0061)	ND(0.0054)	ND(0.006)	ND(0.0059)	ND(0.0065)	ND(0.006)	ND(0.0065)	**0.0076**	ND(0.0057)	**None**
Vinyl Chloride (mg/kg)	ND(0.0061)	ND(0.0054)	**0.012**	**0.025**	**0.033**	**0.011**	**0.120**	**0.0062**	ND(0.0057)	**0.020**
Xylenes, total (mg/kg)	ND(0.018)	ND(0.016)	ND(0.018)	**0.074**	ND(0.020)	ND(0.018)	ND(0.019)	**0.094**	ND(0.017)	**16.0**

	SAMPLE IDENTIFICATION								
Volatile Organic Compound[1]	**MO-SB43 (5.0-7.0)**	**MO-SB49 (10.5-12.5)**	**MO-SB51A (0.5-2.5)**	**MO-SB53 (9.0-10.0)**	**MO-SB53 (9.0-10.0DUP)**	**MO-SB54 (7.5-9.5)**	**MO-SB57 (5.5-7.5)**	**MO-SB57 (5.5-7.5DUP)**	**CALM STARC C_{LEACH} LEVELS**
cis-1,2-Dichloroethene (mg/kg)	**0.0061**	ND(0.0054)	**0.046**	ND(0.0061)	ND(0.0057)	ND(0.0058)	**0.021**	**0.038**	**0.500**
trans-1,2-Dichloroethene (mg/kg)	ND(0.006)	ND(0.0054)	ND(0.0059)	ND(0.0061)	ND(0.0057)	ND(0.0058)	ND(0.0062)	ND(0.0059)	**0.100**
Ethylbenzene (mg/kg)	ND(0.006)	ND(0.0054)	ND(0.0059)	ND(0.0061)	ND(0.0057)	ND(0.0058)	ND(0.0062)	ND(0.0059)	**32.0**
Trichloroethene (mg/kg)	**0.010**	ND(0.0054)	ND(0.0059)	ND(0.0061)	ND(0.0057)	ND(0.0058)	ND(0.0062)	ND(0.0059)	**0.100**
1,2,4-Trimethylbenzene (mg/kg)	ND(0.006)	ND(0.0054)	ND(0.0059)	ND(0.0061)	ND(0.0057)	ND(0.0058)	ND(0.0062)	ND(0.0059)	**None**
Vinyl Chloride (mg/kg)	ND(0.006)	ND(0.0054)	**0.037**	ND(0.0061)	ND(0.0057)	ND(0.0058)	**0.040**	**0.064**	**0.020**
Xylenes, total (mg/kg)	ND(0.018)	ND(0.016)	ND(0.018)	ND(0.018)	ND(0.017)	ND(0.017)	ND(0.019)	ND(0.018)	**16.0**

ND(0.0059) = Not detected at a concentration greater than the listed reporting limit
mg/kg = milligrams/kilogram
C = Standard outside of controls
DUP = Duplicate sample
MO-SB29 (6.0-8.0) = Modine-soil boring location number (sample depth interval)
[1] = VOCs by Method 5035/8260B
CALM STARC C_{LEACH} = Cleanup Levels for Missouri, Soil Target Concentration, Leaching to Groundwater (September 2001)
Shading indicates concentration exceeding CALM STARC C_{LEACH} Levels

TABLE 8

Removal Action Confirmation Samples West Side of Building (CH2M HILL 2002) - Soil Sample Analytical Results

	Volatile Organic Compound[1]		
SAMPLE IDENTIFICATION	cis-1,2-Dichloroethene (mg/kg)	Trichloroethene (mg/kg)	Vinyl Chloride (mg/kg)
MO-1W-01	1.720	ND(0.031)	2.090
MO-1W-01B	0.856	ND(0.025)	0.521
MO-1W-01C	9.730J	ND(0.031)	4.990
MO-1W-02	1.00	ND(0.025)	0.110
MO-1W-02B	4.900	ND(0.034)	8.570
M0-1W-03	ND(0.025)	ND(0.025)	ND(0.025)
MO-1W-04	ND(0.025)	ND(0.025)	ND(0.025)
MO-1W-05	ND(0.025)	ND(0.025)	ND(0.025)
MO-1W-05D	ND(0.025)	ND(0.025)	ND(0.025)
MO-1W-06	0.401	ND(0.025)	0.088
MO-1W-06D	ND(0.025)	ND(0.025)	ND(0.025)
MO-2W-01	0.490	ND(0.031)	ND(0.031)
MO-2W-01D	0.389	ND(0.031)	ND(0.031)
MO-3W-01	0.409	ND(0.029)	ND(0.029)
MO-3W-02	0.211	ND(0.029)	ND(0.029)
MO-4W-01	0.110	ND(0.029)	ND(0.029)
MO-4W-02	1.14	ND(0.029)	ND(0.029)
MO-5W-01	0.590	ND(0.029)	0.071
MO-6W-01	0.065	ND(0.029)	ND(0.029)
MO-6W-02	0.361	ND(0.029)	ND(0.029)
MO-6W-03	ND(0.032)	ND(0.032)	0.052
MO-6W-03D	ND(0.032)	ND(0.032)	ND(0.032)
MO-7W-01	5.38	ND(0.035)	0.737
MO-7W-1B	ND(0.029)	ND(0.029)	ND(0.029)
MO-8W-01	0.387	ND(0.029)	0.031
MO-9W-01	1.19	ND(0.030)	0.216
MO-10W-01	3.340	1.010	0.092
MO-10W-02	22.80	9.260	0.279
MO-10W-03	ND(0.031)	ND(0.032)	ND(0.032)
MO-10W-04	ND(0.034)	ND(0.034)	ND(0.034)
MO-10W-05	ND(0.030)	ND(0.030)	ND(0.030)
MO-10W-06	3.420	ND(0.031)	ND(0.031)
MO-10W-07	1.120	ND(0.028)	ND(0.028)
MO-11W-01	1.820	0.154	0.130
MO-11W-02	ND(0.025)	ND(0.025)	ND(0.025)
MO-11W-03	2.71	0.048	0.657
MO-11W-03B	ND(0.029)	ND(0.029)	ND(0.029)
MO-11W-04	11.60J	0.168	3.00
MO-11W-04B	ND(0.031)	ND(0.031)	ND(0.031)
MO-12W-01	ND(0.032)	ND(0.032)	ND(0.032)
MO-12W-02	ND(0.030)	ND(0.030)	0.089
MO-12W-03	ND(0.032)	ND(0.032)	0.110
MO-13W-01	0.359	ND(0.032)	0.100
MO-13W-02	1.77	ND(0.032)	ND(0.032)
MO-14W-01	0.051	ND(0.030)	ND(0.030)
MO-14W-02	ND(0.037)	ND(0.037)	0.069
MO-14W-03	0.060	ND(0.030)	0.041
MO-15W-01	ND(0.035)	ND(0.035)	ND(0.035)
MO-15W-02	ND(0.033)	ND(0.033)	ND(0.033)
MO-15W-03	ND(0.036)	ND(0.036)	ND(0.036)
MO-16W-01	ND(0.032)	ND(0.032)	ND(0.032)
MO-16W-02	ND(0.031)	ND(0.031)	ND(0.031)
MO-16W-03	ND(0.031)	ND(0.031)	ND(0.031)
MO-SP-02	1.570	ND(0.028)	ND(0.028)
SITE-SPECIFIC CLEANUP LEVELS	8.68	0.38	0.32

MO-SP-02 = Sample collected beneath former contaminated soil stockpile
MO-1W-01 = Sample collected from excavation wall
ND(0.028) = Not detected at a concentration greater than the listed reporting limit
mg/kg = milligrams/kilogram
[1] = VOCs by Method 5035/8260B
Bold denotes positive detection
Shading indicates concentration exceeding site-specific cleanup levels
J = Estimated concentration
D = Field Duplicate

TABLE 9

Former Monorail Vapor Degreaser Investigations (Law 1991, Dames and Moore 1997) - Soil Sample Analytical Results

	1991 ESA by LAW				
Sample I.D.	HA-1	HA-2	HA-3	HA-4	HA-5
Sample Depth (Feet)	2.0-4.0	4.0-4.3	0-2.0	0-0.75	0-2.0
Collection Date	10/5/1991	10/5/1991	10/5/1991	10/6/1991	10/6/1991
ANALYTE					
Vinyl Chloride	ND	ND	ND	ND	0.027
Trichlorofluoromethane	ND	ND	ND	ND	0.011
1,1 - Dichloroethene	ND	ND	0.0041	ND	ND
Methylene Chloride	ND	ND	ND	ND	0.61
total - 1,2,Dichloroethene	ND	ND	ND	ND	0.016
1,1-Dichloroethane	ND	ND	ND	ND	0.072
Chloroform	0.0018	ND	ND	ND	0.083
1,1,1-Trichloroethane	0.55	0.014	0.018	0.0018	200
1,2-Dichloroethane	ND	ND	ND	ND	0.42
Trichloroethylene	3	0.029	0.01	ND	0.78
1,1,2-Trichloroethane	ND	ND	ND	ND	0.27
Tetrachloroethene	0.36	ND	ND	ND	0.13

Notes:
Units in milligrams/kilogram (mg/kg)
ND = Not Detected
B = Analyte identified in blank

	1997 Subsurface Investigation by Dames & Moore																
Sample I.D.	P-1	P-1	P-2	P-2	P-3	P-3	P-4	P-4	P-5	P-5	P-6	P-7	P-7	P-9	P-9	P-10	P-10
Sample Depth (Feet)	8-12'	16-17'	10"-4'	4-6'	10"-4'	4-5.5'	10"-4'	4-6'	0-4'	6-7.5'	5"-3.5'	4'	4.5-5.5'	0-4'	4-7'	4-8'	8-11'
Collection Date	5/16/1997	5/16/1997	5/16/1997	5/16/1997	5/16/1997	5/16/1997	5/16/1997	5/16/1997	5/16/1997	5/16/1997	5/16/1997	5/16/1997	5/16/1997	5/16/1997	5/16/1997	5/16/1997	5/16/1997
ANALYTE																	
Acetone	0.022	ND	0.076	0.02	0.027	0.012	0.012	0.045	ND	0.025	0.043	0.12	ND	ND	ND	ND	0.05
1,1 - Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.007	ND	0.03	0.77	ND	ND	ND	ND
Methylene Chloride	0.012	0.006	0.009	ND	0.005	ND	ND	0.016 B	0.026	0.052	0.05 B	0.11 B	ND	0.03 B	0.044 B	ND	0.051 B
total - 1,2,Dichloroethene	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.096	ND	ND	ND	0.024	0.018
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.006	ND	0.079	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.024	1.8	6	ND	0.011	ND	ND
Trichloroethylene	0.086	0.006	ND	ND	ND	ND	0.048	0.01	ND	0.05	0.008	4	3.4	0.008	0.014	0.08	0.066
Tetrachloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.014	ND	ND	ND	ND	ND

TABLE 10
Indoor Air Sampling Results
(CH2M HILL 2003)

Field ID	Description	Analytical Method	Analyte	Result (ppbv)	Lab Q	Screening Level (ppbv)	Occupational Exposure Limit, (ppbv)
MD-AS-01	Office wing	TO14	Methylene chloride	1.13		560	25,000
	conference	TO14-SIM	Tetrachloroethene	0.2		47	25,000
	room	TO14	Trichloroethene	14.6		84	50,000
MD-AS-02	Office wing	TO14	cis-1,2-Dichloroethene	0.88	J	29	200,000
	restroom	TO14	Methylene chloride	0.64	J	560	25,000
	sink area	TO14-SIM	Tetrachloroethene	0.517		47	25,000
		TO14	Trichloroethene	61.5		84	50,000
MD-AS-03	NE plant	TO14-SIM	Tetrachloroethene	0.578		47	25,000
	corner	TO14	Trichloroethene	46.7		84	50,000
MD-AS-04	Training room	TO14-SIM	Tetrachloroethene	0.443		47	25,000
	near chem.	TO14	Trichloroethene	56.5		84	50,000
	storage area	TO14-SIM	Vinyl chloride	0.009		81	1,000
MD-AS-05	Center of	TO14-SIM	Tetrachloroethene	0.602		47	25,000
	plant near	TO14	Trichloroethene	42.2		84	50,000
	welding bays	TO14-SIM	Vinyl chloride	0.015		81	1,000
MD-AS-06	S end of plant	TO14	cis-1,2-Dichloroethene	0.62	J	29	200,000
	in historical	TO14	Methylene chloride	0.81	J	560	25,000
	degreaser	TO14-SIM	Tetrachloroethene	0.528		47	25,000
	location	TO14	Trichloroethene	34.6		84	50,000
MD-AS-07	OUTSIDE	TO14-SIM	Tetrachloroethene	0.053		47	25,000
	SAMPLE	TO14-SIM	Trichloroethene	0.204		84	50,000
MD-AS-08	Duplicate	TO14-SIM	Tetrachloroethene	0.582		47	25,000
	of MD-AS-05	TO14	Trichloroethene	42.7		84	50,000
		TO14-SIM	Vinyl chloride	0.015		81	1,000
MD-AS-B1	Blank	TO14-SIM	Trichloroethene	0.025		84	50,000

Notes:
J = The analyte was positively identified but the reported value is estimated.
Screening Level - Based on MDNR recommended modifications of 10^{-4} Target Cancer Risk and 9 hr/day exposure time (Slope factor for TCE based on California EPA's risk assessment), rounded to two significant digits.
Occupational Exposure Limit value is the lowest of the OSHA PEL, ACGIH TLV or NIOSH REL.
OSHA PEL = Occupational Safety and Health Administration Permissible Exposure Limit
ACGIH TLV = American Council of Governmental Hygienists Threshold Exposure Limit
NIOSH REL = National Institute for Occupational Safety and Health Recommended Exposure Limits
Conversion from ug/m^3 to ppbv is based on standard conditions (760 mm Hg and 25 deg C).

Appendix A

Calculation for Conversion from Total Concentration to Soil Gas Concentration

Parameter	Symbol	Value
Henry's Law Constant	H	chem-specific
Soil density (g/cm3)	ps	1.5
Soil moisture content	theta_w	0.15
Soil organic carbon partition coefficient (cm3/g)	koc	chem-specific
Fraction organic carbon in soil	foc	0.006
Soil-water partition coefficient	ks	koc x foc
Air-filled porosity in soil	theta_a	0.28
Molar volume of gas		24.45

$$C_{soil} = C_{soil\,gas} \times \frac{\theta_w + K_s\ \rho_b + H\theta_a}{H\ \rho_b}$$

	C (soilgas)	C (soilgas)	H'	Koc	MW	Ks	C (soil)	C (soil)
Chemical	**Concentration in Soil Gas (ug/m3)**	**Concentration in Soil Gas (g/cm^3)**	**Henry's Law Constant**	**Organic carbon partition coefficient**	**Molecular Weight**	**Soil-water partition coefficient**	**Concentration in soil (g/g)**	**Concentration in soil (mg/kg)**
Trichloroethene	1.44E+06	1.44E-06	4.22E-01	1.66E+02	1.31E+02	9.96E-01	4.01E-06	4.009E+00

DATA ENTRY SHEET

SG-ADV
Version 2.0; 02/03

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
79016	1.44E+06			Trichloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of Ls (cell F24)					
30.48	152.4	13.6	152.4					1.00E-08

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil Parameters				Lookup Soil Parameters				Lookup Soil Parameters			
SI	1.35	0.489	0.167		1.5	0.43	0.3		1.5	0.43	0.3

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	7025.6	1283.2	609.6	1	0.25	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	30	30	350

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	121.92	0.322	0.130	0.130	#N/A	#N/A	#N/A	1.00E-08	16,618	1.44E+06	3.82E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
9.52E+06	1.75E-03	30.48	8,512	5.80E-03	2.47E-01	1.77E-04	7.59E-03	0.00E+00	0.00E+00	7.59E-03	121.92

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
30.48	1.44E+06	1.00	5.76E+01	7.59E-03	1.66E+04	9.60E+01	1.39E-04	2.00E+02	1.1E-04	4.0E-02

END

RESULTS SHEET

Chemical:	Trichloroethylene
Indoor Air Concentration (ug/m^3):	200
Molecular Weight:	131.389
Molar Volume of Gas:	24.4061
Indoor Air Concentration (ppb)	**37.15**

Conversion = [ ] ug/m3 * molar volume / molecular weight

Appendix B

Manufacturer	Description	Part Number	Distributor Name and Part Number	Enviro Code	MSDS Date	Code Number	Areas of Storage or use				Data Date Review	Today is 12/27/2005	Physical Inventory Date
2/13/2003							Pretr	Core Assy	Weld Paint	Maint Tooling			
3M	Spray 80 Neoprene Contact Adhesive	Spray 80			03/23/98	707610	x				08/24/99	**Out of Date**	
Airco	Welding Rod	Airco Easy Arc 7014	AirGas		02/10/99	?				x	05/20/03		5/20/2003
Airgas	Acetylene	C2H2			09/25/00	?				x	01/29/01		
Airgas	Helium	Helium, liquified Helium			12/22/97	?				x	08/08/01		
Air Products and Chemicals	Helium/Argon	Alumaxxplus	PG Walker		02/01/00	?				x	08/08/01		
Airgas	Nitrogen	N2 or liquified N2			09/25/00	?		x		x	02/25/02		
Airgas	Oxygen O2 or Refriigerated liquid O2	O2			12/08/97	?				x	08/08/01		
Alcoa	Aluminum (3xxx Alloys)				08/14/00			x	x	x	08/14/00	**Out of Date**	
All Star Gas	Odorized Propane				01/01/03	700005	x	x	x	x	02/20/03		
Appleton Electric	KWIKO-A Sealing Cement				09/30/98	?				x	04/24/00	**Out of Date**	
AquaComp	Cooling Tower Treatment (Biocide)	AC-4015			04/16/98	704015					07/06/01		
AquaComp	Cooling Water Treatment	AC 335			03/14/98	?					07/18/02		
AquaComp	Cooling Water Treatment	AC 5000			02/15/02	?					08/22/02		
AquaComp	COOLING WATER TREATMENT	AC-503			03/14/98	700503					12/02/98	**Out of Date**	
AquaComp	Liquid Antifoam	AC 38ATF			09/16/98	701201					08/08/02		
AquaComp	TREATMENT CLOSED SYSTEM	AC-301			10/21/02	700301					02/21/03		
Asarco	SULFURIC ACID	1860	Chem Supply		10/01/01	701060					10/15/01		
Asepsis, Inc	Hydrotech Aquabrome Tablets	AHYD22022			09/01/94	705554					10/08/99	**Out of Date**	
Ashland Chemical Co	Isopropanol 99%	3507000			01/26/98	?					06/21/00	**Out of Date**	
Bayer Corporation	Phillips' Milk of Magnesia	301, 302, 303			12/22/95						03/22/99	**Out of Date**	
BetzDearborn	POLY FLOC (POWDER)	AP140			06/01/99	703751					08/23/99	**Out of Date**	
Cambridge Mill Products	Vacuum Pump Fluid	CMP19			01/04/99	?					09/08/99	**Out of Date**	
CARRIER	Centrifugal Compressor Oil	PP23BB006(Mobil DTE 26)			12/08/89	700969					04/17/00	**Out of Date**	
CARRIER	Synthetic Screw Compressor Oil	Castrol Icematic SW-220			11/26/91	?					04/17/00	**Out of Date**	
Chem Supply	Aluminum Hydroxychloride	Chempak CS-8160			04/26/95	708160					10/01/99	**Out of Date**	
Chem Supply	Sodium Sulfide Hydrate	C1-151			11/16/99						09/08/00	**Out of Date**	
Cargil	SALT WATER SOFTENER NACL	CAS 7647-14-5			11/22/00	?					02/18/03		
Modine Camdenton	Wastwater Treatment System Sludge	BV1270-EME		NHW	12/14/97	701270	x				10/31/02		
Chevron	Way Oil Vistac ISO 68, 220	Vistac 220			01/27/99	702090					09/08/99	**Out of Date**	
Clorox	BLEACH CLOROX				10/01/00	702097					09/11/01		
Conoco	Super Hydraulic Oil 22, 32, 46, 68	HYDCO180			07/31/02	701105	x		x		01/08/03		5/6/2003
Cotto-Waxo Company	"Velvet" Oil base Floor sweep compound				03/15/97	?					03/02/98	**Out of Date**	
DAP	Weldwood Nonflammable Contact Adhe:	30534		VOC	02/24/96	704051					08/23/99	**Out of Date**	
Diamond Products	Isopropyl Alcohol 70%				11/01/96	701205					09/03/99	**Out of Date**	
DOW	OIL DOW THERM	SR-1			05/21/02	703138	x				02/26/03		
Dow Corning	Molydenum disulfide grease	BR 2 Plus (10605K42)			07/10/97	701170					10/12/99	**Out of Date**	
DUPONT	FREON 22	R-22		ODP	10/05/96	700010					02/18/03		
DUPONT	FREON 500	R-500		ODP	10/07/96	700050					02/18/03		
DUPONT	Freon 502	R-502		ODP	10/05/03	?					02/18/03		
DYNAFLUX INC	ARCAIR ALUMINUM CLEANER	57-021-200		EIQ	06/01/89	700018					06/17/98	**Out of Date**	
ExxonMobil	Actrel Cleaner	Actrel 3360L		VOC	09/28/01	703360					02/18/03		
Fisher Scientific	ACID NITRIC REAGENT GRADE	A200-500			02/14/03	700517					02/14/03		
Fisher Scientific	ACID SULFURIC REAGENT GRD	A300-500			02/14/03	704704					02/14/03		
Fisher Scientific	Hydrochloric Acid 0.01 to 2.0N	SA48-500			02/14/03	?					02/14/03		
Fisher Scientific	Methyl Orange Solutions	SM54-500			02/14/03	?					02/14/03		
Fisher Scientific	SOLUTION BUFFER PH 7.00	SB108-500			02/14/03	704214					02/14/03		
Fisher Scientific	SOLUTION ELECT. FILL	SP138-500			02/14/03	704217					02/14/03		
Georgia Gulf	SODIUM HYDROXIDE LIQUID 50%	NAOH REGULAR GR			04/01/92	701050					02/21/03		
GOJO	Lotion Cream Soap	1829-01 & 1827-04		na	01/08/96	207892					04/10/00	**Out of Date**	
HACH	AMMONIUM HYDROXIDE Sol 10%	14736-37			None	701077					12/29/99	**Out of Date**	

Hach Company	CuVer 1 Copper Reagent	1421199			11/01/01	705001			11/01/01		
ELF Lubricants	Coffing Hoist Lubricant	SJ-33	Handling Systems 14J1		11/22/99	701410			02/18/03		
Haris Welco	Aluminum Welding wires and rods	1100, 4043, 4047 etc.			03/07/01	?			04/20/03		
Haris Welco	Tungsten Electrodes for Welding	All Types			04/07/00	?			04/20/03		
HARRY COOPER	FREON 100LB DRUM	R11		ODP		701193			06/30/89	**Out of Date**	
Henkel Corporation	RODINE 50 (Inhibitor Surfactant)	50			08/19/94	700032			02/21/03		
Humco	Isopropyl Rubbing Alcohol 70% USP	0395-1249			07/09/97	701205			11/12/98	**Out of Date**	
HYDROX	ALCOHOL RUBBING	ISOPROPYL 70%				705208			03/24/88	**Out of Date**	
Inco Alloy International	Inconel WE 182 Weld Rod	182			01/02/97				12/13/99	**Out of Date**	
INWELD	WELD ROD HARD SURFACING	1/8" 502 9=1LB		EIQ		652803			03/04/96	**Out of Date**	
ITW Devcon	Epoxy Plus 25 Resin & Hardner	14178			12/03/98	701417			12/03/98	**Out of Date**	
Jones-Hamilton Co	Hydrochloric Acid (17% to 39%)	HCL	Chem Supply Co		01/01/00	?			02/21/03		
KIWI Brands	Endust, Original				12/18/96	?			04/07/00	**Out of Date**	
KO MANUFACTURING	CLEANER Ultra HD	#217			05/25/00	700217	x		05/06/03		5/6/2003
KO MANUFACTURING	CLEANER KO 512	#512			06/01/00	704212			05/06/03		
LINCLON	WIRE WELDING .035 44LBS	DO35 L-50		EIQ		651010			09/28/87	**Out of Date**	
LINCOLN	ROD WELDING 3/32 INCH	7014 21=1LB		EIQ		650060			08/12/87	**Out of Date**	
LINCOLN	ROD WELDING 7018X1/8	JET-LH 78MR		EIQ		652543			12/08/93	**Out of Date**	
LINCOLN	WIRE CORESHIELD .030	SP-100		EIQ		653257			04/01/94	**Out of Date**	
LINCOLN	WIRE WELDING .45 25LB	309SS		EIQ		650070			09/26/88	**Out of Date**	
Loctite Corp	Form-a-Gasket #2	2B (Item No 80010)			12/27/99	705555			02/18/03		
Loctite Corp	Form-a-Gasket Silicone Blue RTV	6B (Item No 80627)			01/22/96	?			10/07/98	**Out of Date**	
Loctite Corp	LOCTITE 404 1 OZ	46551			01/03/95	703121			05/01/95	**Out of Date**	
Loctite Corp	242 Threadlocker Medium Strength	242	McMaster-Carr 91458A15		12/09/01	702132			02/20/03		
Loctite Corp	Nickel Anti-Seize Lubricant	51102			12/29/02	703555			12/29/02		
Loctite Corp	SCREWLOCK EV 50MML	079-31				703132			01/16/89	**Out of Date**	
Loctite Corp	SOLVENT CLEAN UP	(753-53) 76820			11/01/85	700856			10/03/89	**Out of Date**	
LPS	Heavy Duty Rust Inhibitor	LPS 3 Grainger 6y745		VOC	08/12/94	701906			04/17/00	**Out of Date**	
Lubecon Systems	LUBRICANT CHAIN 6GAL 40LB	SER 1M 6GA 40LB			05/13/98	709156			05/28/98	**Out of Date**	
Magnaflux	Spotcheck Cleaner/remover	SKC-NF			09/22/93	?			04/25/94	**Out of Date**	
Magnaflux	Spotcheck Developer	SKD-NF			09/22/93	?			04/25/94	**Out of Date**	
Magnaflux	Spotcheck Penetrant	SKL-SP			08/23/93	?			04/25/94	**Out of Date**	
Master Bond Inc	Supreme 11HT Part A&B	Supreme 11HT			01/17/00	707893			04/14/00	**Out of Date**	
MG Industries	Argon				12/11/01	700004			04/01/02		
MIDWEST AIRGAS	ICE MELT					701097			06/23/98	**Out of Date**	
Modine Manufacturing	CLEANER ALKALINE ALUMINUM	C-20		RMU	11/30/99	700020			06/27/00	**Out of Date**	
Modine Manufacturing	Liquid Test Tank Dye	TT-12L			11/30/99	?			04/10/01		
Modine Manufacturing	LUBRICANT (5 GAL DRUM)	PS-1805		VOC	11/30/99	703125			11/30/99	**Out of Date**	
Modine Manufacturing	LUBRICANT (55GAL DRUM)	PS-1815		VOC	11/30/99	703124			07/27/00	**Out of Date**	
Modine Manufacturing	LUBRICANT (SQUARE WAVE)	PS-1825		VOC	11/30/99	701875			04/10/01		
Modine Manufacturing	Metal Cleaner	DG-21			06/15/99	700021			08/23/99	**Out of Date**	
Modine Manufacturing	Petroleum Red Dye				06/08/01				06/08/01		
MOTOR OIL INC	COOLANT SEMI-SYNTHETIC	#300				702542			03/09/95	**Out of Date**	
MOTOR OIL INC	COOLANT SYNTHETIC	Premier 450	McMaster-Carr 1216K11,12,11		02/25/02	?		x	02/03/03		
Norton Company	Aluminum Oxide Grinding Wheel	Alundum			03/15/96	?			08/26/99	**Out of Date**	
Norton Company	Coated Abrasive Product	Norzon R821	Grainger 7S879		02/01/91	?			10/02/02		
Norton Company	Resin Grinding Wheel	Norzon	Grainger 7SJ67		03/22/96	451208			10/02/02		
Norton Company	WHEEL GRINDER CUP ENDMILL	662435-30398			02/11/92	456624			05/29/98	**Out of Date**	
Oakite	DEOXIDIZER LIQUID NON CHR	LNC		RMU	02/28/94	702222			04/12/00	**Out of Date**	
Oakite	Testing Solution 20	OKT6343			10/22/97	?			09/14/00	**Out of Date**	
Oakite	Testing Solution 38					?			09/14/00	**Out of Date**	
Oatey	Oatey All Purpose Cement	30816,30821,30834,30847,30848			05/28/97	154765			05/18/00	**Out of Date**	
Oatey	Oatey Cleaner - 005	30779-4,30782-8,30795-16,30805-32			06/21/93	154764			05/18/00	**Out of Date**	

Omni Technologies	BRAZING PASTE 8LB JARS	LTB 39-00SSK NC			04/01/98	701161		09/13/99 **Out of Date**
OxyChem	Caustic Soda Liquid 50% All Grades				12/30/93	701050		10/15/01
PENNZOIL	GREASE WHITE MULTI-PURP.	705 STOCK 7755			06/01/01	700030	x	02/14/03
Phillips 66	AUTO TRANSMISSION FLUID	DEXRON III			05/01/94	702505		09/23/99 **Out of Date**
Phillips 66	GREASE WHEEL BEARING	ASM-3			06/30/98	701945		03/23/99 **Out of Date**
Phillips 66	GREASE HIGH TEMP (14 OZ)	POLYTAC EP-2			01/29/93	701935		03/23/99 **Out of Date**
Phillips 66	Hector Steam Cylinder Oil	Hector ISO VG 630A			06/30/93	702814		10/22/99 **Out of Date**
Phillips 66	Low Sulfur Diesel Fuel	#2 Distillate			07/31/98	?		01/01/02
Phillips 66	OIL	ROCK DRILL 300			06/30/93	702510		09/23/99 **Out of Date**
Phillips 66	OIL GEAR PHILUBE (5GAL)	SMP SAE 85W-140			06/30/93	702010		09/23/99 **Out of Date**
Phillips 66	OIL GEAR PHILUBE (5GAL)	SMP SAE 85W-90			06/30/93	701980		09/23/99 **Out of Date**
Phillips 66	OIL HYDRAULIC (MAGNUS A 315)	A ISO VG 68			06/30/93	701750		09/23/99 **Out of Date**
Phillips 66	Oil Magnus A 1000	A ISO VG 220			06/30/93	701130		09/23/99 **Out of Date**
Phillips 66	OIL MAGNUS A 150	A ISO VG 32			06/30/93	701105		09/23/99 **Out of Date**
Phillips 66	OIL MAGNUS A 46	A ISO VG 46			06/30/93	701836		09/23/99 **Out of Date**
Phillips 66	OIL MAGNUS A 465	A ISO VG 100			06/30/93	701730		09/23/99 **Out of Date**
Phillips 66	OIL MOTOR Tropartic	20W-20			03/31/94	702100		09/23/99 **Out of Date**
Phillips 66	OIL MOTOR Tropartic	SAE-30			03/31/94	701930		09/23/99 **Out of Date**
Phillips 66	OIL MOTOR TYPE MM	SAE 30			06/30/93	702095		09/23/99 **Out of Date**
Phillips 66	OIL MOTOR TYPE MM	SAE 40			06/30/93	702091		09/23/99 **Out of Date**
Phillips 66	PROPANE	HD-5 Propane		EIQ	09/30/97	700005		7/29/1998 **Out of Date**
Phillips 66	Syndustrial E Compressor Oil	PHILESCO 100			06/28/96	702056		04/19/00 **Out of Date**
PPG	PAINT GLADSTONE GRAY	7-816-4754		VOC		356874		01/30/97 **Out of Date**
PPG	PAINT REGAL BLUE SPRAY	55-326		VOC	06/01/90	350125		06/01/90 **Out of Date**
PPG	Paint Speedhide INT Eggshell Latex	6G (6-411,415,416,417)			10/03/96	351697		09/15/99 **Out of Date**
PPG	PAINT TUEXEDO GRAY	4763				356024		02/11/94 **Out of Date**
PPG	POWDER M630 BLACK	PCF 90117			07/02/02	350630		10/14/02
Pro ColorFlex Ink Corp	Ultra Perm. Opaque Ink				08/12/98	850521		08/14/98 **Out of Date**
Rae Products & Chemicals	Yellow Zone Marking Paint	2492	McMaster-Carr 10785T25		04/20/00	?		04/06/01
Revere Products	PAINT GLOSS BLACK 10 OZ	40110		VOC	02/12/96	350871		04/10/97 **Out of Date**
Revere Products	PAINT SEMI-GLOSS 10 OZ	RUST-NIX H2O		VOC	11/08/94	350874		03/11/98 **Out of Date**
RIGID	OIL THREAD CUTTING DARK	70830				701910		01/19/88 **Out of Date**
RUSTOLEUM	PAINT GRAY MACH TOOL	904			04/27/00	355963		02/20/03
RUSTOLEUM	PAINT PRIMER RED	5269			12/04/92	350236		09/21/99 **Out of Date**
RUSTOLEUM	PAINT SAFETY FEDERAL BLUE	925			04/27/00	351690		02/20/03
RUSTOLEUM	PAINT SAFETY FEDERAL RED	964			04/27/00	350205		02/20/03
RUSTOLEUM	PAINT SAFETY ORANGE	956			04/27/00	351682		02/20/03
RUSTOLEUM	PAINT SAFETY YELLOW	944			04/27/00	350202		02/20/03
RUSTOLEUM	PRIMER QUICK DRY GRAY	7086			01/22/90	355964		09/27/99 **Out of Date**
RUSTOLEUM	THINNER	641		VOC	06/11/97	352149		11/11/99 **Out of Date**
RUST-OLEUM	PAINT SAFETY ORANGE SPRAY	2155			02/02/01	350352		02/20/03
SchweiB-und Lotstoffe BmbH	Caesium Flux	Al-Flux 2805 Cs3			01/01/02	?		08/28/02
Sherwin-Williams	PAINT FLAT BLACK 10 OZ	S04102		VOC	08/17/98	350873		08/23/99 **Out of Date**
SOLVEY FLOURIDE	NOCOLOCK Flux	Product No 47		RMU	10/07/99	700034		01/10/00 **Out of Date**
Solvey of Mexico	Sodium Sulphide Hydrated					700705		01/01/85 **Out of Date**
SPARTAN	SOAP PINK LOTION	HIL0038500				202051		11/01/89 **Out of Date**
Spectrum Laboratory Products	Conductivity Solution (10K)	C1530		Acid	06/23/99	704218		03/09/01
Spectrum Laboratory Products	Conductivity Solution (Std 10 Sol)	C1515			03/19/01	704220		03/19/01
Spectrum Laboratory Products	Conductivity Solution (Std 2,764 Sol)	C1602			03/16/01	704219		03/19/01
ST INDUSTRIES	CLEANER SURFACE GRANITE	600001				701246		03/09/88 **Out of Date**
STOCKHAUSEN	HAND CLEANER (KRESTO)	87033				202100		04/19/89 **Out of Date**
Strombecker Corp	Tootsietoy Bubbles				06/03/98	700102		06/03/98 **Out of Date**
Synchem/Chippenham	Sulfamic Acid	NH2SO3H	Chem Supply Co		06/08/91	?		02/21/03

Taylor Technologies	ALKALINITY TEST KIT	K-1533			706523	07/17/96 **Out of Date**
Taylor Technologies	CALCIUM BUFFER, DB PINT	R-0653-2-E		05/01/96	701117	07/29/98 **Out of Date**
Taylor Technologies	CALCIUM HARDNESS TEST KIT	K-1567			706524	07/17/96 **Out of Date**
Taylor Technologies	CALCIUM INDICATOR POWDER	R-011P-J 1/4 LB		05/01/96	701116	03/30/98 **Out of Date**
Taylor Technologies	CAN Solution	R-0820		05/01/96	700804	05/01/96 **Out of Date**
Taylor Technologies	Chromate Indicator	R-0630		05/01/96	701119	05/01/96 **Out of Date**
Taylor Technologies	Ferroin Indicator	R-0819		05/01/96	700803	05/01/96 **Out of Date**
Taylor Technologies	Hardness Reagent	R-0683		05/01/96	701118	05/01/96 **Out of Date**
Taylor Technologies	Molybdenum Buffer Solution	R-0890		05/01/96	700806	07/01/02
Taylor Technologies	Molybdenum Indicator Powder	R-0900		05/01/96	700809	07/01/02
Taylor Technologies	Molybdenum Indicator Solvent	R-0901		05/01/96	700810	07/01/02
Taylor Technologies	Molybdenum Titrating Solution	R-0892		05/01/96	700808	07/01/02
Taylor Technologies	Phenolphanthalein Solution	R-0638		04/01/98	700801	05/01/96 **Out of Date**
Taylor Technologies	REAGENT SILVER NITRATE,DB	R-807-E		05/01/96	700807	03/30/98 **Out of Date**
Taylor Technologies	Sulfuric Acid N	R-0686		05/01/96	700802	05/01/96 **Out of Date**
Teledyne Advanced Material	Thoriated Tungsten	1/16",1/8",3/32" x 2%		03/08/94	?	04/10/00 **Out of Date**
Thermal Ceramics	Kaowool Paper	700 Grade		03/15/00	?	07/12/00 **Out of Date**
THERMAL DYNAMICS	TORCH COOLANT	7-2850		12/10/97	657285	02/20/03
TNEMEC	ACRYLIC POLYMER SEMIGLOSS	BLUE	VOC	04/15/96	350031	04/10/00 **Out of Date**
TNEMEC	ACRYLIC POLYMER SEMIGLOSS	WHITE	VOC	04/15/96	350030	04/10/00 **Out of Date**
TREMCO INC.	PRIMER TREMPRIME Q.D.	NO. 6			351569	11/13/92 **Out of Date**
TRUCO	SEALER SUPER SEAM	7141 (TOP COAT)	VOC		351568	12/10/92 **Out of Date**
TRUCO	SEALER TRU-MASTER SEAM	7165 (FLASHING)	VOC		357165	05/16/94 **Out of Date**
TULCO OILS	LUB S OIL	Waylube 220		06/12/02	?	10/25/02
VALVOLINE LITHI	GREASE BLK. MOLY EP SPEC.	633 MULTI/PURP.			700031	04/12/91 **Out of Date**
Wal-Mart	Color Place Rust Control Spray Paint	21000 Series			?	11/01/90 **Out of Date**
Welch Vacuum Technology	Directorr premium vacuum pump oil	8995P		01/14/91	459170	11/11/91 **Out of Date**
Weld-Aid Products	Nozzle Kleen #2	007022		02/01/99	?	06/14/00 **Out of Date**
York Sales Company	Nozzle Gel Compound 101	92100		None	?	07/12/02
Zep Manufacturing Co	Original Orange Intro Hand Cleaner	0991		01/01/98	203020	04/03/01
Zep Manufacturing Co	SUN SOLV DEGREASER CLEANR	0419-193D	VOC	03/04/93	702054	04/03/01
Zep Manufacturing Co	Zep Painter's Partner	0953		03/27/01	201010	08/16/02

MSDS in Book	**159**
MSDS Missing	**27**
Out of Date	**115**